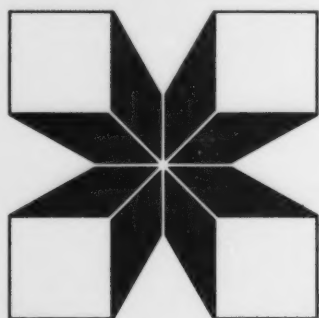


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C A N A D A

**NEW HORIZONS
IN AGRICULTURAL
INFORMATION MANAGEMENT**

PROCEEDINGS

OF AN INTERNATIONAL SYMPOSIUM

MARCH 13-16, 1991

BEIJING, CHINA

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La présente série est réservée aux documents issus de colloques, aux rapports internes et aux documents techniques susceptibles d'être publiés plus tard dans une série de publications plus soignées. D'un tirage restreint, le rapport manuscrit est destiné à un public très spécialisé.

Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.

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Proceedings of an International Symposium,

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Compiled and Edited by

Gary K. McCone



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Foreword

This is a remarkable publication. It brings together over forty papers addressing different aspects of agricultural information in China, thereby providing a unique insight into current approaches and priorities. The papers cover a range of topics, including strategic overviews on the agricultural information system in China, the application of new information technologies for managing information services, and practical experiences of converting agricultural information into productive action. These perspectives are complemented by several additional papers written by information specialists based elsewhere in Asia and from selected international organizations. The net result is a unique compendium that does indeed explore "New Horizons in Agricultural Information Management".

The message conveyed by these papers reconfirms that information is a valuable resource for development. The International Development Research Centre (IDRC) has long recognized this fact. From its inception in 1970, IDRC has endeavoured to play a practical role in applying knowledge for social and economic development. One of its mechanisms has been to maintain a substantive program of support for strengthening the management and utilization of information for development research and action. In China, this support has included a number of information projects in agriculture and other fields, as well as installation of IDRC's MINISIS software at the Sciencetech Documentation and Information Centre of the Chinese Academy of Agricultural Sciences (SDIC-CAAS) and elsewhere. A related objective of IDRC is to foster international cooperation through information-sharing. The International Symposium held in Beijing in March 1990, and the publication of these Proceedings, were supported in keeping with this objective. The evidence presented in this volume amply demonstrates that the information community in China is ready to play its part in meeting the immense challenges ahead. The contributions reveal quite dramatically the breadth of advances in automation and information science techniques in China. Readers are encouraged to establish contact with the authors.

Organizing this International Symposium, which involved over 70 participants from 12 countries, was a complex and demanding task. Full credit and thanks must be given to Professor Wang Xianfu and his team at SDIC-CAAS. This was a well-prepared, smoothly managed, and much-enjoyed event.

Equally daunting must have been the task of editing over 60 papers for inclusion in these Proceedings. For this we are indebted to Gary K. McCone of the USDA National Agricultural Library (NAL). It was his sterling effort and linguistic skills that made this publication possible.

IDRC began its formal collaboration with the Chinese Agricultural Information Services in 1986. We are delighted this association has led to the appearance of this present document that can be shared with a larger audience. These Proceedings will serve as a valuable record of the contributions of so many people active in the information field. We wish them continued success as they seek out the "New Horizons".

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Problems, Issues, and Challenges for Agricultural Information Systems and Services in the Developing World

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1. Introduction

Agricultural development is the key to the alleviation of the problems of poverty and low standard of living in most developing countries. This fact alone has resulted in large investments in agricultural research and development everywhere in the world. Significantly, knowledge arising out of agricultural research and development in one country or region has validity and application in other parts of the world. Access to such knowledge and the effective communication and utilization of this knowledge is therefore a vital component in global developmental efforts. Information is the most fundamental of all resources in the sense that all other resources depend on information and knowledge; it is the perception and evaluation of resources which makes their use possible (Ploman, 1985). There is increasing evidence that a country's capability to develop is strongly correlated with its capability not only for research but also its capability to provide access to information and knowledge required in furthering its economic development strategies and goals.

Information workers -- by which term I include librarians, documentalists, information system analysts, computer professionals, communications specialists, media personnel language specialists, extension workers, authors, editors, publishers, data analysts, graphics designers, reprographics personnel, database designers, and other intermediaries -- have undoubtedly played an important role in ensuring that useful information and knowledge is properly captured, stored, retrieved, communicated, transmitted, interpreted, translated, analyzed, and repackaged. Each of these categories of information workers has his own tool box comprising software, hardware, theories, models, norms, practices, procedures, and techniques which distinguishes him from the other categories of information workers. The common thread that binds all these different specializations is the concern for access to information and its communication. Emerging products, systems, and services made possible by new information technologies are enabling the apparently different streams to converge in ways that were

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not possible before. The potential of these emerging technologies goes much further than merely providing more efficient means to access information. They have the potential to amplify our relationships with the social and physical environment, and more importantly reshape the information content and our perceptions of society (Ploman, 1985). There is no doubt that we are living in an exciting era where as information specialists we can contribute significantly to the developmental goals of the countries we work for.

The questions that we need to ask ourselves in the developing world are: "How ready and equipped are we to utilize the new and emerging technologies? What is it that we can do to make ourselves more capable of effectively utilizing these new technologies? and What are the technologies that seem to be potentially most useful?"

The present paper is an attempt to answer some of these questions.

2. Agricultural information in the developing world

I believe that the agricultural information scene in the developing world in comparison with that in other sectors such as industry, health, etc., is indeed quite encouraging. My optimism is based on several facts.

First is the fact that many developing countries, even the small ones, have shown that they are conscious of the need to, and willingly participate in a global effort such as AGRIS. As of 1989, eighty of the ninety developing country members of the United Nations participated in AGRIS. The number of new countries joining the AGRIS network has steadily increased since its inception. Although there may be some who feel that the level of participation of developing countries is still not adequate, the very fact that there is such participation today as compared to even a decade ago is encouraging. The challenge of course is to see how the participation can become more substantive than today, how the quality of participation can be improved, and most importantly how users of agricultural information can be provided easier and wider access to information required in planning, research, development, technology transfer, problem solving, and decision making.

A second significant fact is that in the last decade or so several special libraries and information centers have been set up in the developing world. The Technical Centre for Agricultural and Rural Cooperation's (CTA) directory (Niang et al., 1988, p. vi) on information sources on tropical agriculture lists 337 libraries/information centers or services in the ACP (African, Caribbean, Pacific) countries as of 1988. Of these, 255 or 76% were set up between 1960 and 1987. West Africa alone has 121 libraries or 36% of the 337 centers. Undoubtedly, many of these libraries/information centers are operating in sub-optimal conditions, with inadequate resources and limited skills. The important point is that these new centers were set up using resources that could well have been spent in other sectors. This fact alone is proof enough of the concern for access to information. The challenge is to see how these new centers can be made more

effective agents in the drive to provide better access to information for the users in these regions.

A third fact is that in the last decade or so, several specialized information analysis centers (SIACs) have been set up at national, regional, or international research or academic institutions in the developing world. SIACs are highly focused centers with well-defined mandates and objectives, and provide a variety of information retrieval, analysis, and dissemination services to carefully selected clientele in one or more countries of the developing world. The databases developed and information services of the International Buffalo Information Center (IBIC) in Thailand, the International Irrigation Information Center in Israel, the Bamboo Information Center in the People's Republic of China, and systems in the International Agricultural Research Centers (IARCS) of the Consultative Group on International Agricultural Research (CGIAR) are examples of SIACs that have filled a real need in the developing world. SIACs have been able to build good rapport with potential end-users and often coverage in their areas of interest is better than that of global databases in agriculture. Further, in recent years many SIACs have taken quite successfully to the utilization of new information technologies considerably improving their capabilities to handle information.

Another notable fact of the information scene in the developing world is that of the regional initiatives that have taken place to improve access to agricultural information. The Agricultural Information Bank for Asia (AIBA) in the Philippines, Centro Interamericano de Documentación e Información y Comunicación Agrícola (CIDIA) in Costa Rica, the Caribbean Information System for the Agricultural Sciences (CAGRIS) in Trinidad and Tobago, and réseau Sahélien d'Information et de Documentation Scientifiques et Techniques (RESADOC) in Mali, West Africa are some examples of regional initiatives. The setting up of a regional agricultural documentation and information center in 1989 in Bangladesh under the auspices of the South Asian Association for Regional Cooperation (SAARC) is yet another example of a regional initiative in the area of agricultural information.

3. Issues and problems

3.1 Capacity utilization and user-sensitization

It is clear that new capacity for the management of agricultural information in the developing world has been created mostly in the last ten or fifteen years. Most of these capacities have not yet reached their full potential. There is a consensus among information workers in many developing countries that existing services are not adequately utilized. On the other hand, there is the feeling among users that services of many agricultural information centers do not always meet their needs.

The reasons for poor capacity utilization are not difficult to see if we remember that many of the facilities, recent as they are, have concentrated mainly on resource building, and in improving their skills and information handling capabilities. They have had little or no time and funds to sensitize users to their resources and services. Nor have they attempted systematically to understand user needs. The result is that users have not

been adequately prepared to utilize built-up capacities. Many users in developing countries are not aware of the value of information in general, and the kinds of services they can and should seek from information systems such as represented in this symposium. This situation is further exacerbated by the fact that, by and large, training and education in the developing world is still not adequately oriented to making students/researchers sensitive to the value of libraries and published information as integral components of the educational/research process. It is also true that decision-making on the basis of facts and upon analysis of trends has yet to become the norm while intuitive judgement and person-to-person communication remains the most common source of information in developing countries. In particular, policy makers, planners, and administrators have not yet realized the role of qualitative and analytical data and other types of information in overall social and economic development.

The lack of end-user sensitivity to information obviously has implications for the priority and support that information systems and services get from the governments of the developing world. Information systems will grow and be valued only if they can demonstrate their usefulness. And, to demonstrate their usefulness, information systems need to go headlong into the user community to improve their understanding of user needs, and so that users get a better appreciation of what information systems can do for them. I believe that user sensitivity is so fundamental to the well-being and continued growth of information systems and to the effective use of information, that the conduct of user-awareness and information use promotion programs must be given the highest priority. Efforts in this direction are even more important, according to me, than the application of new technologies to the management of information. Mere application of new technology will not bring about a change in the behavior or attitudes of users. Deliberate and conscious effort is called for and I think such effort is an essential preparation for the effective application of new information technologies.

3.2 Coordination and networking

Some of the main reasons for user dissatisfaction with the services of agricultural and other information systems in the developing world may be said to be as follows:

- absence of customer-orientation in services,
- poor collections of information resulting in poor document delivery services and inadequate access to primary information,
- lack of exhaustivity and timeliness in information provision,
- inadequate capability to access external sources of information,
- inefficient methods of information storage and retrieval, and
- lack of skills for repackaging and consolidation.

Some of the above lacunae may be traced to the limited funds available to most agricultural information systems. Some gaps in performance exist because of the lack of skills, while a third category of reasons can only be addressed by the use of newer technologies. Last, but not the least, one or more of the above mentioned lacunae can be redressed by better coordination and networking.

It would be naive to think that financial resources for the sustenance and growth of agricultural information systems will change for the better. On the other hand, given the rising costs of informational materials (e.g., journal subscriptions), salaries of professional staff, and costs of other services (e.g., photocopying), it would be realistic to assume that available funds in real terms will at best be at the level of what they are today. Donor funding of agricultural information systems also is not likely to change substantially. Much of the donor funding until now has been for local capacity development and indications are that there will be a shift towards funding for systems that would enable better sharing of resources. There is no doubt that it would be in the long term interest of agricultural information systems to devote resources and effort to bring about better sharing of their resources and improved coordination in their operations and services.

Concepts of library and information networking are not new. Some elements of networking existed even before computers and data networking, e.g., centralized cataloging. In more recent years, however, a combination of circumstances triggered mainly by falling funds for libraries and the need to deal with increased information flows forced the pace of library networking in the west. The opportunity afforded by new technologies (e.g., computer-communications networks, microcomputers, user-friendly software, exchange formats, downloading) enabled libraries to cooperate with each other in interlending of publications, mutual access to their catalogs and databases, development of union catalogs, etc. Similarly, libraries were able to coordinate their acquisitions, technical processing, software and hardware acquisition, and training as a result of formal networking.

Coordination and networking is the weakest facet of agricultural and other information systems in the developing world. This is undoubtedly something to be concerned about. Although some effort has been made, e.g., regional networks spoken of earlier, the real impact for the user in terms of efficient document delivery and wider access to information has been negligible.

Here again preoccupation with resource building has not directed enough attention to resource sharing and coordination. Also, the lack of formal structures and agreements set up specifically to promote resource sharing, and the absence of policies that encourage sharing and coordination has not been conducive to networking. The fact that computer-based networking is capital-intensive, requiring investments in imported equipment and costly telecommunications infrastructure by governments is another reason why such technologies have not yet made a significant impact in most developing countries.

Effective networking and sharing of resources requires reliable and rapid intercommunication between facilities and the means to quickly access and search remote databases. You cannot share resources without knowledge of each others' resources. Electronic mail and telefax together with vendor systems such as Dialog, and utilities such as OCLC have enabled rapid access to databases and effective intercommunication between libraries greatly facilitating interlending and other forms of cooperation.

The technology of library networking in the west began with large centralized bibliographic utilities (e.g., OCLC, RLIN) connected to libraries through leased lines. The trend is towards distributed processing and distributed networking and increased local autonomy made possible by the use of integrated automated systems usually bought from commercial vendors. However, local systems are acquiring the capability to link with each other and with the utilities for shared cataloging and interlending. The trend clearly is towards decreasing dependence on shared remote computer facilities and increased cooperation carried out on a small scale, among libraries with a very high affinity of interests (Hildreth, 1987). In the scheme of things, as they are emerging, there is a place for both the large utility as well as the local system.

I believe that there are lessons in the experience of the west for computer-based networking in developing countries. To begin with, I think the initiatives must come from a centralized agency with a perspective that decision and action will gradually devolve to local systems as they become more computer-proficient and as the communications infrastructure of the country improves. Another reason for suggesting centralized initiatives is the need to create a climate for cooperation and coordination, and for the provision of a forum for the development of methodologies, tools and skills. A third reason for suggesting centralized initiatives is that it would be more cost-effective to equip one center with the resources and skills required of such a center. Further, a star network configuration in spite of its disadvantages may be a good starting point for computer-based networking activities in a country with little or no experience in computer-based networking.

The feasibility of setting up at least one center in each country or region with no other operational responsibility than to promote coordination and cooperation among existing facilities is worth examining. Specifically such a center will perform the following functions:

- develop and maintain union catalogs, especially of serials and make available such tools in hard copy and machine-readable forms to local facilities and others,
- enable the exploitation of external databases for those local facilities that do not have resources and/or skills for such exploitation,
- promote the use of international standards in information handling,
- promote the development of local databases in specialized areas,
- advice on hardware and software acquisition,
- provide referral services,
- provide training in computer-based methods, use of microcomputers, database design, online searching, etc.,
- develop generic software or applications based on generic software, e.g., Micro CDS/ISIS, for distribution to local centers,

- assist in conducting user needs studies and user-awareness programs, and generally promote/market information services of the country/region,
- provide a forum where managers of local systems can meet regularly to discuss issues specific to coordination and cooperation, and
- liaise with other national, regional or international centers for mutual benefit.

3.2.1 International cooperation

The scope for sharing of resources, experience and expertise between IARCs and national/regional information systems is considerable given the comparative advantages that IARCs have. This fact was recognized in a meeting of Documentation and Information Officers of the IARCs held at ICRISAT (CGIAR, 1989) in India in 1989 in which several information personnel from national systems also participated. The meeting recommended, among other things, that one way of strengthening national agricultural information systems would be for the establishment of regional information networks as partnerships among national agricultural research systems (NARSs), regional agricultural information programs, and IARC information programs. It is envisaged that in such networks IARCs together with regional systems would be able to assist NARSs to articulate needs and demands and, ultimately to increase their service capacity. Also, it is envisaged that building on existing resources, network activities would address the following areas:

- Strengthening links between the three types of information service programs.
- The human resources and infrastructure needs of NARSs agricultural information systems.
- Collaboration between and, among IARCs, NARSs, and regional programs.

3.3 Information policy

Although several developing countries have enacted policies on food, education, population, environment, etc., policies relating to information activity is conspicuous by its absence. There is a widely held view that the information issue is of a sectoral dimension and not of an intersectoral or national one. Even where there is an information policy, it is not unusual to find that the connotation of information in the policy is a narrow one, e.g., mass media. The sectoral view of information has not been conducive to the emergence of an unified approach to information systems development. Some sectoral policies, notably in agriculture, have given rise to information sub-policies and therefore have provided the opportunity for information efforts to emerge in that sector. However, such sectoral policies have had little impact on information activities or use in other vital sectors.

The absence of well defined information policies in the developing world may be traced to the general lack of sensitivity among policy makers and planners to the role that good information systems can play in social and economic development. A large measure of

the responsibility for the absence of good information policies must rest also with information systems as they have not made a real impact.

Ideally, an Information policy for a country or region will have sub-policies for libraries; library and information networking; database development within the country; access to governmental information; copyright; education and training of information professionals; telecommunications and data networking, including policy for access to external networks; computer software and hardware, including the import and export of these; import and export of information products, e.g., journals, databases, training materials, CD-ROM products; electronic media; advertising; and on transborder data flows. Questions pertaining to tariffs, e.g., for use of data networks by libraries and for educational purposes as opposed to such use for commercial purposes need to be addressed in an information policy. Absence of such a policy leads to situations in countries where it is easier to import cosmetics than it is to import scientific journals.

Given the fact that information systems in agriculture predominate, and are probably the best endowed in terms of resources and skills in most developing countries, I believe that such information systems can play a useful role in formulating national policies on information. From an operational point of view, I believe that agricultural information systems should be acutely conscious of the intersectoral dimensions in planning their systems and in the provision of services. New information technologies fortunately provide us with the capabilities for integrating information from closely related sectors into the core sector and in the provision of services. Although this is not a substitute for a coherent information policy for a country, agricultural information systems by pursuing a broad perspective hopefully will be able to provide the leadership in bringing about needed and viable information policies with a national dimension.

I stress the need for a well thought out information policy in developing countries, because it is only through such a policy that well thought out information programs using appropriate technologies can be formulated. In the absence of a policy, all application of technology is likely to be ad hoc and piecemeal, and serving at best limited objectives. This does not of course mean that agricultural information systems should not use or experiment with new technologies. On the contrary, they should actively utilize new technologies and as far as possible consciously educate their clientele and the policy makers about the advantages of such use.

3.4 Human resources development

The importance of adequately trained manpower to manage and run agricultural information systems in the developing world is all too obvious to need any emphasis. The capacity for education and training of information workers in different parts of the developing world is highly variable, and in some countries it is non-existent. Further, facilities to train information personnel in skills required to utilize newer tools and techniques in information handling is seriously lacking. The situation requires a number of responses, some of which are given below:

- development of training materials, including self-learning kits and modules in specific areas,

- more opportunities for on-the-job and hands-on training of information workers in the better equipped information facilities of the developing world, e.g., at IARCs,
- strengthening of national training capacities through consultancies, sabbaticals, and opportunities for training of trainers,
- collaborative action by international agencies (IAALD, FID, UNESCO, CTA, etc.) to set up need-based regional training courses, and
- traveling workshops where one or two experienced information specialists spend a few weeks in selected national centers in training and demonstration, including addressing end-users of information systems.

4. Information technology

4.1 Microcomputers

The trigger technology of the information revolution is undoubtedly the computer (Olsen, 1989). The convergence of three key technologies, viz., computers, telecommunications and microelectronics, and the development of a whole range of media (magnetic, optical and now magneto-optic), software, products, and services constitutes the package being called information technology.

A recent publication (Feeney, 1986) on information technology provides a helpful categorization of the field into ten broad areas comprising hardware, software, practices, technical processes, and storage media. Even a cursory look at the categories and sub-categories is bewildering. Clearly the trend is the convergence of technologies used to create, store, and distribute information, while the options of doing so are becoming more prolific.

If I were asked today to choose the technologies with the most promise for developing countries, I would choose microcomputers, CD-ROM and Electronic Mail as the three candidate technologies. I believe that these three technologies, properly applied, can bring about substantial improvements in enabling easier and wider access to information for end-users of all kinds. This does not of course mean that other products or systems will not have a place or use in the developing world.

Developing countries, by and large, missed out on the early phases of the information revolution, viz., the mainframe computer, and to a great extent, the minicomputer eras. This was understandable considering the relatively high cost of these technologies. However, the development of microcomputers in the 1970s, the maturing of this technology in the 1980s, and the affordability of microcomputers by even small developing country institutions has truly democratized computing power.

Microcomputers are making slow but steady inroads into the developing world, and could well become the trigger technology of the information revolution in the developing world. Significantly, many recent developments in information technology are

microcomputer-related (e.g., CD-ROM, desk top publishing, local area networks, expert systems). Many of the developments in data communications also depend on developments in microprocessors, bringing about a reduction in costs of switching devices, communications controllers, and modems -- key elements in data networking. There has been a steady increase in microcomputer word size and speed from 8-bit systems to the present 32-bit machines. Random access memory (RAM) is no longer a limiting factor in microcomputer applications in libraries and information storage and retrieval. Similarly external read-write memory, mainly winchester disks, have increased in capacity over the years. Some of the 32-bit systems offer up to 140 MB of hard disk storage. There is then the promise of read-write magneto-optic disks with envisaged capacities of up to 256 MB.

While advances in computing and peripheral hardware have been spectacular, it is the software industry which is today the driving force of the information technology revolution. A key reason for this is the overwhelming demand from customers for packaged software that will let them apply computers to a broad range of tasks. The software market for microcomputers far exceeds that of mainframes and minicomputers and millions of non-technical users can use microcomputers today, thanks to user-friendly software packages.

Microcomputer-based software for library applications including integrated systems and information retrieval is now so plentiful that choosing and evaluating appropriate software for a specific application has become a specialized task. The range of software available for libraries and information centers is evidenced by several directories of applications software now in-print (Dyer and Brookes, 1986, Keren and Sered, 1983, Walton and Taylor, 1986). In addition to packaged software, there are application generators and database management systems (DBMS) packages which offer many facilities for the advanced information system analyst/programmer to develop special or general purpose applications.

Special mention must be made of the Mini-Micro CDS/ISIS software package developed by Del Bigio of UNESCO, first introduced in 1986 and now in its second version (Version 2.3). It is significant that this package has been distributed free of cost to over 3,000 sites in the developing world, and there is already evidence that a number of libraries/information centers have begun to use it to build local databases. The latest version of the package comes with a host language interface. It is possible to use a version of standard Pascal called CDS/ISIS Pascal to build interfaces to or applications using CDS/ISIS databases. Very importantly there are now several formal and informal CDS/ISIS user groups in the developing world actively exchanging news, experiences, and advice on using CDS/ISIS.

What is of some concern, however, is that many centers in the developing world are building databases without an underlying philosophy in their design, and without much concern for the standards and guidelines that already exist, thanks to the efforts of national and international bodies. This underlines the urgent need for training of information workers in the developing world.

4.2 Optical disks

The biggest addition to technologies aimed at increasing access to information has been optical disks including CD-ROM. Pilot scale optical disk applications of the U.S. Library of Congress and the U.S. National Agricultural Library have emphasized the conservation of fragile material (old photographs, posters, etc.) and integration of full text, half-tones and graphics, linked to an indexing database, affording easy access.

The CD-ROM, however, has the potential for a breakthrough in the transmission of scientific and technical information to developing countries. CD-ROM as a publishing medium has been exploited by database producers to package databases that were hitherto only available online on remote vendor systems. Significantly, all three major databases in agriculture, AGRICOLA, CABI, and AGRIS (just announced) are available on CD-ROM. In addition the database of the Royal Tropical Institute, Amsterdam, viz., Abstracts on Tropical Agriculture is also available on CD-ROM. Even more recently the French agency for international cooperation in agricultural research, the Centre de cooperation internationale en recherche agronomique pour le developpement (CIRAD) has produced a CD-ROM product called SESAME which allows access to valuable French literature on tropical agriculture. In addition to bibliographic databases on CD-ROM, reference publications on pesticides useful to agricultural information centers have made their appearance on CD-ROM.

Two projects which aim at packaging full text of agricultural literature on CD-ROM must be mentioned. The first of these being implemented by the CGIAR Secretariat in Washington, will include the full text (including the images and graphics) of publications of twenty IARCs. The idea is to make available a compact disc library of IARC publications to developing country institutions. A prototype of the product was recently evaluated in several sites all over the world. Results of the evaluation are awaited and it is envisaged that the final product comprising some 6,000 formal and informal publications of the twenty IARCs will become available by the end of 1991.

The second project (Olsen, 1989) is that of the Albert R. Mann Library of Cornell University which has begun work on identifying core literature that provides optimal value to agricultural research and education. The four-year project, begun in June 1989, will develop core lists in eight carefully delineated sub-disciplines of agriculture. Eight volumes, one each for the eight sub-disciplines will be published and will contain core lists of primary monographs, primary serials, reference publications, and specialized literature. Developing country lists are also being planned, and in addition it will be possible to divide the lists by geographic regions.

The Mann library project is unique in that this is the first time that such a comprehensive work has been planned. Further, the project uses a combination of bibliometric analysis and expert evaluation. The usefulness of the project is already being seen in the results achieved so far with the first volume on agricultural economics and rural sociology.

The aim of the project is to make available to CD-ROM publishers a definitive analysis and evaluation of the scholarly record in the agricultural sciences so that the full text

of such literature can then be put on CD-ROM for distribution to developing countries. When this happens, agricultural libraries around the world will have core agricultural libraries on CD-ROM greatly alleviating the problems of document delivery. Very significantly, donor agencies have shown interest in this project, the potentials of which are indeed far reaching.

It is clear that CD-ROM, particularly for agricultural information centers, is a medium that cannot be ignored by developing countries.

5. Conclusion

In this keynote address, I have attempted to mix reason with caution and optimism. I hope I have succeeded in providing some food for thought.

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Database Design at ICRISAT and the Experience of Using External Databases

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1. Introduction

This paper outlines what we believe to be general principles of database design, and how these have been applied at the International Crops Research Institute for the Semi Arid Tropics (ICRISAT) for the design of an inhouse bibliographic database, and the experience of using data from two external databases in the creation and maintenance of the inhouse database.

2. Database design principles

2.1 Hardware and software independence

A bibliographic or other database must be viewed as a collection of data elements and relationships between data elements describing real world entities. In the case of bibliographic databases, the entities are books, journal articles, reports, non-book materials, subject terms, names, etc.

The database is not an end in itself but a means to an end. The needs that a database should serve may be said to be:

- it should describe entities (e.g., documents, projects, personnel, etc.) sufficiently adequately,
- the information retrieved from the database should be useful in research, development, problem-solving and decision-making,
- it should provide data for the management and control of functions, and
- it should enable the production of required reports, information products, and services.

Given the above view of a database, it follows that the conceptual design of a database can and should be independent of hardware or software considerations. The database

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needs first to be conceptualized before it can be implemented in a specific hardware-software environment.

Conceptualization of the database includes providing answers to the following questions:

- What types of entities will be described in the database?
- What characteristics of the entities being described are important? Can the characteristics be defined unambiguously?
- How will the characteristics be determined and described?
- What information and processing needs will the database need to satisfy?
- Who will use the database: information specialists, end-users, or both?
- What data-elements need to be shared between processes/functions?

2.2 The database as a central resource

It is essential to think of a database as a single central resource, around which the different information products and services of an information system should be built. The database must contain all the ingredients that go into meeting probable information needs and in producing all routine information products or reports.

The danger of not viewing the database as a single central resource is the need to create more than one file or database to satisfy different needs or applications. A common example is the tendency to treat the library catalog as different from an information retrieval system describing material such as journal articles, conference papers, reports, etc. The result is two databases, each probably following different rules, styles, and standards. From the point of view of a user, he/she will need to use two databases and probably learn two query languages.

Although conceptually a database is talked of as a single resource, in practice it comprises several logically related files. Software systems ensure that so far as the user is concerned the database appears to be a single entity. This is because the data elements constituting the records of the database can further be categorized into files with well-defined relationships between the files. The software system ensures the interaction between files, e.g., when a change takes place in a given file, the software takes care of making the necessary changes in one or more related files. A good software package or application system ensures that the interaction between the different files of a database is completely transparent to the user.

Database design with certain categories of software also involves the definition of the files constituting the database and their interrelationships. By file relationships we mean the extent to which they share data elements and/or exchange data among themselves. For instance, an acquisition system may export bibliographic data into the cataloging system files and vice-versa.

2.3 Data integration vs. functional integration

It is necessary to distinguish between integration of data in a database and integration of functions in a library or information system. The identification of all useful data elements describing different entities, the analysis of their inter-relationships, and the grouping of these into logically related files is data integration. The extent to which data integration is done may vary from system to system. At one extreme, records are created, one or more for each application, with redundant storage of data across files. On the other hand, the designer may have subjected the collection of useful data elements to a critical analysis for relationships before grouping them into logically related files.

Integration of functions, on the other hand, means the capability of a system to perform more than one function, usually in a chain of functions, without redundant entry of data, i.e., with sharing of data between functions, and shared access to files created and maintained primarily for the management and control of a given function.

For instance, in an integrated library system, the acquisitions subsystem would have query access to the cataloging subsystem files for duplication checking or for capture of bibliographic data required, for example, to acquire another copy of a book already held by the library. Similarly, the circulation subsystem may have access to the cataloging subsystem files and vice-versa. Some files, e.g., an authority file, may be shared by more than one subsystem.

In addition to the requirements for sharing of data and files between functional subsystems, an integrated library system may also need to draw data from an external database. For instance, a cataloging or acquisitions subsystem should be developed so that it could utilize MARC records available on a vendor's system or on a database on a library network (or cooperative).

There is a close relationship between data integration and functional integration. Traditionally, library functions were automated as separate, stand-alone applications. Attempts were made subsequently to integrate the different applications into a single system. In many cases, this meant substantial re-design of one or more applications since the original design did not take into account the close interrelationships between functions and the possibility of shared data and shared access to files of these functions.

3. Internal and external factors in database design.

In addition to considering the above mentioned broad principles of database design, it is important that the internal and external factors, i.e., the environment in which a database exists, should also be taken into account in database design. The following are considered important:

3.1 Internal factors

- kinds of bibliographic or other entities that are considered important in a given organization,

- data elements that are special to the organization planning the database,
- searchability, processing, and output products and services that are considered necessary and useful in the given environment,
- the volume of input data and the expected yearly growth of the database,
- the skills available for description and subject characterization of input items,
- the hardware and other infrastructural facilities available, and
- the software available and its capabilities, e.g., its database definition, search, and report generation capabilities.

3.2 External factors

- exchangeability, actual or potential, of the database with other organizations, and
- derivability of the database from one or more global or regional databases, i.e., the possibility that the inhouse database may draw information from one or more external databases.

4. Design decisions at ICRISAT

4.1 Hardware and software independence

In its present form the database is envisaged as a single flat file consistent with the software package that was available, viz., BASIS. In the event that this needs to be implemented on a different category of software package (e.g., Relational database management system), the relationships between different data elements would need to be more explicitly defined than required by traditional information retrieval (IR) software packages.

The structure has, however, been implemented using a mainframe software package called BASIS developed by Battelle as well as on Micro CDS/ISIS.

4.2 As a central resource

The database at ICRISAT in its present form is considered to be a central resource having the following characteristics:

- it integrates both conventional library material (i.e., monographs), as well as other documentary units such as journal articles, conference papers, book chapters, etc. Further, there is provision to describe different kinds of bibliographic entities (monographs, journal articles, theses, conferences, patents, standards, reports)
- the database together with a suitable end-user interface (which is still to be developed) is also considered as being a potential online public access catalog (OPAC) apart from its obvious use as an information retrieval system

- the following output products are generated from the database:
 - catalog cards for monographs
 - monthly accession lists
 - SDI outputs
 - on-demand search outputs
 - current-awareness lists
 - ad-hoc bibliographies

In its present form, however, the database is not designed to support functional integration. A conscious decision not to go in for an integrated system was taken because of factors in the internal environment. The overriding reason for the decision not to integrate functions was the fact that at ICRISAT, the mainframe computer (a VAX-11/780) was already overloaded, and an integrated system which would necessarily have to be based on the mainframe because of the size of the database, and the need for customer access to the database, would have resulted in a system with an unacceptably poor response time and an even more overloaded system. Further, disk storage on the mainframe is a premium resource at ICRISAT and not enough of it was available for the development of an integrated system.

We believe that our experience is probably true of most developing countries where the mainframe computing resources required to develop an integrated system are generally not available. In the developed world this is not the case since most libraries talking about integrated systems are those that have computers dedicated to library automation, and further they have the benefit of vendor systems that provide them access to centrally and cooperatively created cataloging data. This further points to the need in the developing world to adopt a different strategy for integration. Microcomputer-based Local Area Networks (LAN), read-write optical disks, and CD-ROM databases offer the possibility for developing countries to think of truly integrated systems. Until such a time, laterally integrated systems, i.e., systems that are functionally disparate but which exchange data through special programming, seems to be one way of achieving a measure of integration.

4.3 Use of external databases

A third important decision taken at ICRISAT was that the inhouse database would capture its information from two global databases, viz., CAB International (CABI) and the International Information System for the Agricultural Sciences and Technology (AGRIS) of the U.N.'s Food and Agriculture Organization (FAO). The rationale for the choice of these two databases is that the former covers the conventionally published literature of agriculture quite comprehensively and has high quality abstracts, while the latter also covers nonconventional literature of agriculture particularly from the developing world due to the fact that it obtains its input from national input centers all over the world.

It was decided that we would integrate data from the external databases with locally generated input into a single database to serve multiple end-uses including that of an Online Public Access Catalog (OPAC) at a future date. The decision was taken only after a careful examination of one of the internal factors mentioned in Section 3.1, viz., the expected volume of input data with which we would need to contend. It was found that on average the relevant new input each month from the two sources would be about 400 records. This volume of input was just about what we could manage with the existing professional staff at the ICRISAT library and Documentation Services Division.

The two external databases have different structures, follow different styles, and use different rules for bibliographic description, and hence integration of data from these two sources requires some human intellectual effort, and this is directly proportional to the volume of input that is required to be added each month.

By integration is meant not only the merging of data from the two sources but also ensuring that the data so merged are internally coherent and mutually consistent. In other words, data in some fields are reformatted to take care of differences in the bibliographic description rules; incomplete data in fields of the external databases are completed to the extent feasible; and missing elements added wherever necessary. More importantly, an effort is also made to augment the indexing of the items drawn from the two databases. The augmentation is more to slant the indexing of items where required, given the better understanding that we have of the clientele that is required to be served.

In actual practice, the AGRIS tape received each month is subjected to a selection operation to identify those records that are of interest to ICRISAT. A computer program scans the AGRIS tape to do this. The subset of AGRIS data is simultaneously converted into a fixed format file called a FORMS file whose structure is defined in the BASIS data definition language (DDL), a prerequisite to the establishment of a database using the BASIS software. Once this is done, the data can then be loaded into the BASIS database. The program not only restructures AGRIS data to conform to the inhouse database structure but it also looks at specific fields/subfields to extract data that should go into other fields of the inhouse database. For instance, information on the affiliation of the first author of an item appears in the author field of the AGRIS record within parentheses. The inhouse database, on the other hand, has a separate field for affiliation. The computer program written to create an AGRIS subset looks for the affiliation field in the AGRIS record which is then transferred to the appropriate tagged field of the inhouse record. A similar operation is performed with the CABI tapes received each month. A different computer program is used to restructure the CABI data.

In writing the computer programs an attempt has been made to minimize the manual editing effort required to transfer data from two sources into the inhouse database. The computer program cannot take care of differences in style that exist in the two databases, and this is addressed manually. Proof copy of the data from AGRIS and

CABI is edited by professional staff and corrections are made to the FORMS file before it is loaded into the inhouse database.

4.4 Inhouse database structure

Since it was decided that the inhouse database would be built with data from the two external databases, the structuring of the inhouse database required an examination of the structures of the two external databases.

In practice, the structure of the inhouse database was designed *a priori* using the Reference Manual for Machine-readable Bibliographic Descriptions (Dueruckx, 1981) as the source format for the identification of mandatory and optional data elements (fields and subfields). The data element definitions as found in the Reference Manual were used as the standard for the inhouse database. Once the initial structure was designed, the worksheets of AGRIS and CABI and their database production manuals (Martinelli, 1979; CAB International, 1986) were examined. The purpose of the examination was to find out the following:

- common data elements
- unique data elements
- differences in bibliographic description between the two databases
- differences, if any, in data element definitions

Based on the above examination, useful data elements not covered by the Reference Manual were added. One example of a field that was added is the variant author field in use in the CABI database. It was felt that this was a useful data element to be added to the inhouse database considering the wide variations that exist in the rendering of names of Indian, Arabic, European, and other regions. The variant author field which is also indexed enables author searches to be more flexible.

Following the addition of fields that were required for other purposes (e.g., the date of data entry field required to partition the database for SDI services, and the index string field which holds a string of index terms to be used in producing articulated indexes for a bibliography or current awareness list), equivalence matrices were drawn up to determine the kind of mapping between the fields of the two external databases and the inhouse database.

The mappings fall into one of the following kinds: one-to-one, one-to-many, many-to-one, many-to-many or one-to-none. The one-to-one mappings are obviously the simplest to handle. The handling of other kinds of mappings depends on the way the source database distinguishes components or subfields of a given field. If the subfields in the source structure are explicitly demarcated, then it is possible for a computer program to identify the fields/subfields and distribute them unambiguously into one or more fields or subfields of the target structure. However, this is not often the case. An example is the way the CABI database treats conference documents. There is no way that a computer program can determine where the conference was held, and the dates

of the conference. One-to-many mappings in such cases would require manual editing effort.

The mapping matrices together with information on the differences in bibliographic description helped in writing the computer programs to restructure and re-format data in the source structure to the target structure, i.e., the inhouse database.

4.5 Database production manual

It was considered essential to develop a database production manual for the inhouse database. The manual defines different data elements, provides examples, and rules for bibliographic description of various elements. The manual is used as a reference both when creating local input as well as when editing input from the two external databases. The manual has also helped in creating authority files for names of persons, corporate bodies, and titles of serials. It is envisaged that these authority files will become computer-resident and will be used to automatically validate data received from the two external source databases as well as for data added locally.

4.6 Local input

An important added value to the database comes from locally generated input. This includes bibliographic data for books, reports, and other monographic material added to the library. Nonconventional literature accessed by the library by virtue of its exchange relationships with several libraries in the semi-arid tropics (SAT) is an important source of locally generated input. Formal and semi-formal literature originating within ICRISAT is another item of input added locally. Very importantly, each document added to the library is examined to see if analytics (chapters or papers) from the document should be added to the database. We believe that it is this kind of input that adds real value to an inhouse database, since most such information is not available in the external databases. In terms of volume, locally generated input at ICRISAT accounts for 20% of the total input.

4.7 Subject accessibility

It is well known that the two external databases use different thesauri to index their records. A conscious decision was taken to distinguish terms of the *CAB Thesaurus* from that of the *AGROVOC* of AGRIS in the inhouse database. Two separate fields called descriptors and identifiers have been designated to hold *CAB Thesaurus* and *AGROVOC* terms respectively. Local input is indexed using the *CAB Thesaurus* as the control vocabulary. Here again the lack of disk space has not enabled the mounting of a machine-readable thesaurus that could be used to validate input.

Search strategies and user profiles need to recognize the availability of terms from the two vocabularies. This does indeed put a burden on the information specialist searcher, and would probably be unacceptable in non-delegated, end-user searching. However, data in the descriptor and identifier fields can both be mapped into a single field for the purposes of a search or in a user profile. This kind of mapping is allowed by the software used. Given this facility, the fact that there are terms from two terminologies can be made transparent to the end-user. Conceptually, it is possible to think of a

user-interface which will provide access to terms of both thesauri in an integrated manner.

Given the seemingly unalterable fact that more than one global database in the area of agriculture will continue to exist, and the fact that they will continue to use different vocabularies, it becomes necessary for local systems such as that at ICRISAT to contend with the inevitable differences by seeking software solutions that to some extent minimize the disadvantages of separate rules for bibliographic descriptions, and different vocabularies for subject characterization. The database at ICRISAT and the methodology for its creation and maintenance is an attempt in this direction.

4.8 Duplicate checking

It is well known that there is overlap in the coverage of the two external databases (Deselaers, 1986), and that several common records exist in the two databases. The elimination of duplicate records has been done using a feature of the BASIS software which allows the definition of a duplicate check key in the Data Definition. This key is automatically created for all records that are added to the database, and the key for new records is matched against that of the older records. Potential duplicates, if any, are flagged. These are then checked manually before being discarded or retained.

We have not discovered any apparent pattern in the occurrence of duplicate records in the two databases each month. This is understandable considering that we are concerned with a very small subset of each of the two databases. As a rule, when duplicate records do arise, the CABI record is retained and the AGRIS duplicate is discarded. This is because of the abstracts in the CABI records.

4.9 Exchangeability

One of the main reasons for using the Reference Manual as the source format for the inhouse database was to ensure that it has at least a minimum set of data elements for the identification and description of different types of bibliographic records. Also, conforming to standard data element definitions and bibliographic description rules, we believe will enable us to provide our search output or subsets of our database to interested institutions in an internationally accepted exchange format. Computer programs have already been written to convert records in the BASIS database into a ISO 2709 formatted file. It is also possible, given the tagging scheme of an institution, to download our records to conform to the scheme of the institution wishing to receive our records. The idea is to provide subsets of our database to interested agricultural research stations in the semi-arid tropics (SAT), especially in Asia and Africa, for possible use with Micro CDS/ISIS. Although we have not attempted it, we do not think it would be difficult to convert our records into the structure of the Common Communications Format (CCF).

4.10 Some statistics

Table 1 provides some data on the extent of use of the two external databases and internal input in the creation and maintenance of the inhouse database.

Year	AGRIS input	% of total	CABI input	% of total	Local input	% of total	Total
1988	1269	26.45	2322	48.40	1207	25.16	4798
1989	1758	25.32	3822	55.04	1364	19.64	6944
Total	3027	25.78	6144	52.32	2571	2190	11742

Table 1.

5. Conclusion

A methodology for building an inhouse database using subsets of two external databases has been conceived and implemented at ICRISAT. We believe that the methodology is suitable for special libraries and information centers operating in specific and well defined areas of agriculture or in mission-oriented organizations. The methodology is probably not suitable for information systems operating in relatively broad areas of knowledge since the human effort involved in integrating external data into the inhouse database will then become substantial, and hence also the cost of building the inhouse database.

We see the following advantages in the building of databases using the methodology described:

- The inhouse database has the potential to become, in the long run, more comprehensive than either of the one or more databases from which the inhouse database draws its information, in the specific areas of interest of a given information system.
- Value addition to the inhouse database is possible in several ways:
 - through local input, e.g., nonconventional literature,
 - through inclusion of other kinds of information, e.g., on specialists, research projects,
 - through slanted indexing.
- Online access to a comprehensive information resource to end-users within the organization through a well designed user-friendly interface at considerably less cost than would be possible by other means. Quite conceivably, as telecommunications in the developing world improve, such databases can be remotely searched from institutions within the country. At ICRISAT, we hope to provide online access to our database to remote users in India. With the emergence of WORM media, there is also the possibility of distributing such databases on optical disks.

- SDI and search services to users based on the inhouse database would have the advantage of wide coverage from a single source at considerably less cost than possible otherwise.

In most developing countries, especially in Asia and Africa, where the telecommunications infrastructure is still too poor or expensive to think of providing end-user access to remote databases outside the country, it would appear that the building of local databases in specific areas of interest is a way out of the situation, until databases on optical disk cover more areas and become available at considerably less cost than they are today.

We believe that an inhouse database should be seen as a repackaged product that not only brings the global database closer to the user but one that adds value by the inclusion of new information and the capability to utilize the information in friendly and innovative ways.

The existence of an inhouse database does not in any way eliminate the need for access to external databases. However, such access will probably be required in the interface and interdisciplinary areas, e.g., biotechnology, food, nutrition, etc., with the inhouse database becoming the mainstay for information retrieval and dissemination services.

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Implementation Results, Roles and Effects of the Chinese Agricultural Information Services Project

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Abstract

The results of the project on Chinese agricultural information services evaluated in the light of predefined goals are presented, and the role and influence of the project are analyzed. It is believed that the theories behind the project are correct and the implementation of the project has reached and exceeded its predefined goals. The project has played a key role in promoting the establishment of an agricultural sciencetech information system at the national level in China. The foresighted project should receive continued support for further development.

The Chinese Academy of Agricultural Sciences (CAAS) and the International Development Research Centre (IDRC) signed a memorandum creating the Chinese Agricultural Information Services project on May 7, 1986. During the past four years, IDRC has invested 358,000 Canadian dollars and CAAS has invested 8,320,000 RMB Yuan to implement the project. With mutual efforts from both sides, the project has been going on smoothly and the expected goals have been obtained.

(A) Targets of the Project

1. General Objectives

- To systematize the identification, collection and processing of significant agricultural literature produced in China;
- To effectively participate in the International Information System for Agricultural Science and Technology (AGRIS) in order that China and the world community will mutually benefit from this cooperative information exchange and to ensure that information can be rapidly and efficiently disseminated to users.

2. Specific Objectives

- To set up a National AGRIS Centre in China to coordinate AGRIS-related information activities throughout the country;

- To set up seven subcentres in the seven administrative regions of China to help the Sciencetech Documentation and Information Centre (SDIC), CAAS, identify, collect and process local agricultural information;
- To improve the facilities and resource conditions at both the national centre and regional subcentres to upgrade their capability to handle and utilize information;
- To train technical information personnel in AGRIS methodology and information sciences.

3. Products

- Chinese abstracts of both Chinese and foreign agricultural literature;
- National agricultural bibliography of China;
- Agricultural review papers on specialized topics;
- Project promotional brochure.

4. Project Services

- Training of users;
- SDI Services from AGRIS and CABI tapes;
- Document delivery (paper and microform);
- Reference Services;
- Translation Services;
- AGRIS input.

(B) Implementing Results of the Project

1. Establishment of the National AGRIS Centre of China and the Seven Regional Subcentres

On the basis of an investigation and discussions conducted by CAAS, China's National AGRIS Centre was set up in SDIC, and subsequently, the seven regional subcentres of North China, Northeast China, East China, Central China, South China, Northwest China and Southwest China were all set up respectively in the Information Institute of Hebei Provincial Academy of Agricultural Sciences, the Information Institute of Liaoning Provincial Academy of Agricultural Sciences, the Information Institute of Jiangsu Provincial Academy of Agricultural Sciences, the Information Institute of Hubei Provincial Academy of Agricultural Sciences, the Information Institute of Guangdong Provincial Academy of Agricultural Sciences, the Information Institute of Shaanxi Provincial Academy of Agricultural Sciences, and the Information Institute of Sichuan Provincial Academy of Agricultural Sciences. The tasks, roles and coordinated regulations were established at the same time. It was decided to hold a technical

consultation meeting every year in one of the seven subcentres and the national centre in rotation, starting with the national centre. Since 1987, leaders of the National AGRIS Centre and seven subcentres have held four consultation meetings to discuss and coordinate services and technical problems in the current year. With support from IDRC, the national centre and the seven regional subcentres all have greatly improved their equipment situation, enhanced the quality of personnel and developed their resources. Now, the national centre has over 70 personnel of senior, medium and junior level and 5-7 personnel in each subcentre who are working on the construction of the Chinese AGRIS system, thus, a backbone contingent of technicians has gradually formed which works effectively.

2. Strengthening of Agricultural Information Transmission Services

In line with the targets of the project, SDIC has begun to publish a series of journals abstracting foreign agricultural literature, including six branch journals in Crop Genetics and Breeding, Agricultural Entomology, Soils and Fertilizers, Animal Science, Veterinary Medicine and Biological Technology; a series of abstract journals of Chinese agricultural literature including also six branch journals of Food and Industrial Crops, Horticulture, Plant Protection, Soils and Fertilizers, Animal Science as well as Veterinary Medicine; and a series of bibliographies including the *Bibliography of Foreign Sciencetech Documents -- Agriculture*, and the *Bibliography of Chinese Sciencetech Documents -- Agriculture*. Meanwhile, a journal which mainly carries general reviews of subject information in agriculture entitled *Information Research in Agriculture and Animal Husbandry* has also been published. About 90,000 records on agricultural information both in Chinese and foreign languages are reported and transmitted throughout the country each year. Among these are more than 20,000 abstracts, 70,000 bibliographic records and about 100 review papers on special topics. They all play an important role in exchanging information, learning of developing trends and achievements in various subjects and improving utilization of agricultural information.

In addition, about 50,000 agricultural documents are copied and transmitted in microform every year.

3. Preliminary Establishment of Computer System

Of the IDRC donation, more than 60% has been used for the establishment of a computer information system at the National AGRIS Centre and the seven regional subcentres. The National AGRIS Centre has been equipped with an HP3000/37 minicomputer, Asian Vectra, 55 MB Winchester, 404 MB and 571 MB disk drives, Chinese-English line-printer and MINISIS software, etc. This equipment has arrived here over a period of time since the second half of 1987 and has all been installed, tested and put into operation. In autumn of 1988, IDRC provided the National AGRIS Centre and each of the seven subcentres with one IBM PS/2 50 microcomputer and Micro CDS/ISIS software in Chinese which has also been installed, tested, and put into operation. At the same time, the National AGRIS Centre raised funds to purchase and install an HP3000/70 minicomputer and necessary peripheral equipment based on the needs of the system. Up to now, the preliminary computer information systems of the National AGRIS Centre and the seven subcentres have been established. Various

training workshops have been held and the computer processing of agricultural information has been performed in a planned and organized way. Since late 1988, we have been sending floppy disks containing our data to the AGRIS Processing Unit in Vienna. The establishment of the Chinese agricultural documentation database was started in 1989.

4. Improvement in Sharing Chinese Agricultural Information Resources

The National AGRIS Centre and the seven subcentres coordinate their input of Chinese agricultural information to AGRIS and CABI databases. In 1985, the input to AGRIS was 714 records, in 1989 it increased to 4,500 and we project some 6,000 records in 1990. The input in 1989 was over six times that of 1985. However, the record quality needs to be further improved. The input to CABI has been 800 abstracts each year from 1985-1989. These selected Chinese agricultural information records inputted into the international agricultural databases can be quickly transmitted to various countries and regions the world over. Many users write to us for reference or copies of full text articles.

Meanwhile, we have been using AGRINDEX and tapes from AGRIS and CABI for online or offline searching. They are well accepted by the users. At present, there are more than 270 permanent users of CABI and over 100 users of AGRIS for SDI.

5. Training Personnel for Document Pretreatment, and for Hardware and Software Applications

Since December 1986, with the support of IDRC, a number of personnel have been trained in various courses at home and abroad in the use of AGRIS, MINISIS, CDS/ISIS, dBASE software, the operation of HP3000 minicomputers, Chinese character input, documentation classification and indexing, and so on. So far, seventeen training courses have been held at home for 588 trainees. A backbone contingent for software and hardware development and the pretreatment of documents is now taking shape formed around more than 100 personnel at the National AGRIS Centre and the seven subcentres, including 28 senior, 46 medium, 49 junior technical staff and 13 assistants. Many other information institutes in provincial (regional or municipal) academies of agricultural sciences, libraries and information centres in universities and colleges and agricultural research stations have also trained their personnel to process and use agricultural information products. This backbone contingent is gradually getting stronger by our continuing to run more training courses, take on apprentices, and conduct on-the-spot teaching, thus providing more and more qualified personnel for fulfilling the tasks assigned by the National AGRIS Centre and for developing agricultural information resources.

6. Speeding up the Construction of Databases for Agricultural Documents

Now that we have equipment and qualified personnel, the construction of databases of agricultural documents has been proceeding quickly. In addition to the input to AGRIS, the National AGRIS Centre organized the seven subcentres according to regions and common standards, to select and process locally produced agricultural documents using floppy disks which are then sent to the National AGRIS Centre for review and input to the main database run on the HP3000 minicomputer. There are now more than

40,000 bibliographic records in the Chinese agricultural documents database; 2,000 abstracts in the database of scientech achievements in agriculture, animal husbandry and fisheries; and 3,000 abstracts in the agricultural abstracts database. In addition, the CABI and AGRIS databases have also been established. All these databases have begun to serve users and we have also tried long distance online retrieval with good results and satisfied users.

7. Database Establishment, Editing, Composing and Printing Chinese Characters within One Integrated Process

So far, there are six journals such as the bibliographies of Chinese agricultural documents and the Chinese agricultural abstracts, etc., which are edited, and composed all in one integrated computer process. In order to do this, a series of programs has been developed: (a) The program for integration of database construction, and composition; (b) The editing program for construction of subject classification; (c) The program for automatic formation of the subject index which uses nine function keys to limit the range of a search in order to maximize the search quality and increase indexing efficiency; and (d) The program for automatically assigning the number of each record to help in accurately editing the database (see papers by Mr. Wang Huaihui and others).

8. Promoting International Exchange and Cooperation

During the implementation of the project with IDRC support, we joined the Fifth and Sixth Technical Consultation of AGRIS, and three annual MINISIS users' groups meetings. And we attended the IAALD Regional Conference: Strategic Issues in Agricultural Information with special reference to developing countries and the International Plant Protection Information Symposium sponsored by CABI in 1989. In addition, we visited the IDRC Regional Office in Singapore and AIBA. Through these international meetings and visits, we have learned of developments and trends in agricultural information, and exchanged ideas and experiences with foreign colleagues. All of these activities are beneficial for improving Chinese agricultural information services.

(C) A Preliminary Analysis of the Implementation Results

With mutual efforts and close cooperation of both IDRC and China, the project has reached its expected goals, with some items exceeding the set targets. For example, the project planned to provide an HP3000/37 minicomputer for the National AGRIS Centre, however, China raised funds by herself to add another HP3000/70 minicomputer; data in the Chinese agricultural documentation database are two times more than that in the original plan; the input to AGRIS has also surpassed the 4,000 records planned for the fourth year; and the data transmitted annually by the National AGRIS Centre are 80% more than the planned 50,000 records. In general, the project has been developing satisfactorily and has realized its original expectations. The success of the project is attributable to its underlying principles, namely, to first concentrate the limited funds for the establishment of the National AGRIS Centre, and then, organize the seven subcentres to form a powerful radiating network and gradually extend its range of influence. The implementing of the first phase of the project will produce far

reaching significance in the development of Chinese agricultural information services. The reasons are as follows:

1. The establishment of the National AGRIS Centre is a significant basis to begin to effectively organize and coordinate agricultural information services throughout the country. Its information products and technical rules may not only serve the agricultural information users, but also play a leading role in the development of the agricultural information system of the country. The establishment of the seven subcentres makes the National AGRIS Centre even more powerful, thus forming an agricultural information network above provincial level with the National AGRIS Centre as the central body and the seven subcentres as its key nodes. This network as a whole will play an even greater role with the improvement of equipment in realizing online and offline retrieval of agricultural information in China.
2. During the first phase of the project, we have already determined how to input Chinese agricultural information into AGRIS and CABI databases in a comprehensive way, and have created conditions for introducing the information products from AGRIS and CABI into China. Actually, this has opened the way for common sharing of the Chinese agricultural information resources. Users who can not read Chinese may learn of Chinese agricultural research highlights from our English bibliographies and abstracts through the international agricultural databases. The first phase of the project supported by IDRC is a very good beginning for the development of Chinese agricultural information resources. Based on this, the results of common sharing of the Chinese agricultural information resources will be gradually extended.
3. The construction of the Chinese agricultural documentation database will provide the agricultural information units at the provincial level with valuable experience and techniques including skills and specifications for document pretreatment, the Chinese agricultural thesaurus and its indexing, as well as development of software, etc. Meanwhile, the national centre and the seven subcentres will continue to sum up their experiences and solve new problems during their advancement, periodically distribute technical bulletins to agricultural information units throughout the country and run technical training courses to be able to continually make the computer retrieval system of Chinese agricultural documents more perfect.
4. At present, the contingent of 100 technical personnel in document pretreatment and data input, and hardware and software development at the National AGRIS Centre and the seven subcentres not only fulfills its own tasks but also plays the role of a disseminator to spread techniques to various parts of the country. Therefore, the strengthening and enlarging of this contingent will have an even greater effect on the advancement of the Chinese agricultural information cause.

(D) Important Role of Agricultural Sciencetech Information on the Development of China's Agriculture

China has a population of 1.1 billion, of whom over 80% are in rural areas. A bumper harvest or shortfall in grain production directly influences the development rate of the national economy. In most cases, a prosperous or depressed economy in China has its background in the increase or decrease of agricultural production in the current year or in the previous year.

A large population with relatively little arable land is one of the serious problems now facing China's agriculture. What is the solution then? The solution may be birth control to limit the increase of population on one hand, but on the other hand, we should rely on good policies, on science and technology and wider input.

From a long-term point of view, science, technology and input are essential, especially because science and technology have tremendous potential. Today, science and technology are developing rapidly in the world, therefore, to solve once and for all the problem of agriculture's impact on the rise and decline of the country by using science and technology should be taken as an extremely important item on the agenda. In order to settle the problem of 1.1 billion people supported by a relatively small area of arable land, great efforts should be spent on enhancing agricultural productivity, increasing crop yield and effectively using agricultural resources. In some high yield areas, the grain output is 15 tons per hectare. If there is no significant breakthrough in technology, it will be very difficult to further increase this yield.

For the development of science and technology, access to sciencetech information is essential. There are over 250,000 agricultural papers published in the world each year. And during the last decade, there were more than 25,000 major agricultural achievements and about 40,000 agricultural papers produced in China each year. This holds tremendous potential for productivity increases in agriculture. The most important thing is to disseminate the advanced and practical techniques and information to the millions of farmers and technicians in a timely fashion. Since 1985, IDRC has supported the project to develop Chinese agricultural information services. This conforms to the needs of the development of Chinese agriculture and has produced significant, impressive results. It is an act of foresight and strategic consideration.

China is a large agricultural information market. There are several million current information users and tens of millions of potential users. Audio-video materials are welcomed by users at and below the county level. The information market is getting more and more brisk in rural areas. The distribution of the *Bulletin of Agricultural Science and Technology* is 470,000 copies. The *Farmer Abstracts* has a circulation of over 1.2 million copies. Electrical information products are also welcomed by scientists, teachers and students above the provincial level.

So, to support the Chinese agricultural information services we will promote the expansion and flourishing of the Chinese agricultural information market and will achieve even greater social and economic benefits.

(E) Suggestions for Extending Chinese Agricultural Information Services

As mentioned above, the first phase of the Chinese Agricultural Information Services project supported by IDRC has been successfully completed. It will exert a long term influence on Chinese agriculture. However, in order to continue to develop, this farsighted project needs to be extended to its second phase.

The AGRIS System and the Participation of China

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Abstract

The paper gives an introduction into AGRIS, the International Information System for the Agricultural Sciences and Technology. FAO and the AGRIS participating centres cooperate in collecting references to agricultural literature and compiling them into a worldwide agricultural database. Output products are the printed bibliographies, the magnetic tapes, the online databases and their equivalent on CD-ROM. Since 1984 the People's Republic of China has been participating in AGRIS.

Introduction

Knowledge in science and technology is usually made available through published literature and it is the obligation of each scientist to be aware of the published literature in his field of interest. In agriculture, for example, the estimated yearly increment of worldwide published documents is over 250,000 documents and special methods are required to handle such a large amount of literature: Large computers are able to store references to the original documents with the possibility of retrieving specific references according to a specific selection criterion.

In 1975, FAO, the Food and Agriculture Organization of the United Nations, founded AGRIS, the International Information System for the Agricultural Sciences and Technology. AGRIS aims at being a worldwide inventory of the published literature in the field of agriculture in its widest sense. AGRIS is therefore a typical bibliographic database, where each unit represents a reference to a piece of literature, such as a journal article, a book, a report, conference proceedings, a thesis or other material. AGRIS further helps to disseminate the information to the user through a set of different output products.

Since the amount of literature is too large to be dealt with by one single country or international organization, AGRIS has been designed as a cooperative system: The operation is shared between FAO, through the AGRIS Coordinating Centre (ACC) in Rome, Italy, and its Processing Unit (APU) in Vienna, Austria, and the national and international/regional participating centres. Each participating centre has the responsibility for reporting all the agricultural literature produced in its country. They collect, catalogue and classify this literature and submit the document references to the AGRIS Processing Unit for inclusion in AGRIS. There is no direct fee paid for AGRIS participation, but costs are involved in preparing the input to AGRIS. FAO has the overall responsibility for the system, and in particular for receiving, organizing and

processing the input and for making the output products available to AGRIS users. ACC establishes and maintains contact with participating centres and monitors the input and output services. One of its essential functions is to train individuals working with the system and to produce and maintain operating manuals and teaching materials. Every second year, all AGRIS participants are invited to a technical consultation held at the FAO to review progress and recommend future action.

In 1989, 134 national centres and nineteen regional or international centres participated in AGRIS.

Some Characteristics of AGRIS

AGRIS subject scope

AGRIS is a mission-oriented system whose objective is to improve the living conditions of the rural population worldwide. The subject scope of AGRIS is the agricultural sciences and technology in its widest sense; it coincides with the scope of FAO itself. The seventeen main subjects are the following:

- Agriculture in general
- Geography and history
- Education, extension and information
- Administration and legislation
- Agricultural economics, development and rural sociology
- Plant science and production
- Plant protection
- Postharvest technology
- Forestry
- Animal science, production and protection
- Fisheries and aquaculture
- Agricultural machinery and engineering
- Natural sciences and environment
- Processing of agricultural products
- Human nutrition
- Pollution
- Methodology

About half the database deals with plant production and protection.

AGRIS accepts all kinds of published materials: serial articles, monographs, reports, patents, standards, maps or atlases, films, computer media, drawings, and phono records. Serial articles make up 75% of the database, monographs about 20%, all the rest not more than 5%.

A study of the original language of documents cited in AGRIS has shown that more than half of the database refers to English literature, followed by French (8%), Spanish (7%), German (6%), Japanese, Italian, Russian, and Portuguese. The rest of the languages contribute less than 1% each, but around 10% in total.

AGRIS Tools

AGRIS has published a set of guidelines, which define the rules for bibliographic description and indexing, for subject categorization, etc. A very important tool is the AGRIS Input Pack, a self-training kit for AGRIS input preparation. The AGRIS Input Pack, available in English, French and Spanish has been shown to be the most important AGRIS reference work.

The most important tool for AGRIS input preparation, however, is *AGROVOC*, the multilingual thesaurus of agricultural terminology. The first edition (by D. Leatherdale in cooperation with many others) was jointly prepared by FAO and the Commission of the European Community (CEC) in 1980-82. Since then many updates have been performed and the next published version is expected in 1990. The first edition was published in English, French, and Spanish, as well as in German and Italian. FAO maintains the first three languages, but work is underway to also have an official Arabic version. AGRIS participating centres have prepared many other language versions, like Portuguese, Danish, etc. Since 1986 each AGRIS reference has been indexed with descriptors from *AGROVOC*. The inputting centre may choose the indexing language (English, French or Spanish), the AGRIS database, however, contains *AGROVOC* descriptors in all three official languages for each reference.

AGROVOC is updated twice a year, the modifications are discussed beforehand in one of the *AGROVOC* meetings. A group of experts with representatives from the different languages meet and discuss the proposals. Proposals for modification usually come from AGRIS (and CARIS - Current Agricultural Research Information System) participating centres who encounter documents which cannot be indexed accurately with the available set of descriptors. During 1988 and 1989 *AGROVOC* has been held unchanged, while the *AGROVOC* group has been working on major changes which will be included in the version to be published in 1990: these are additions of descriptors in specific fields like machinery, bioengineering, veterinary sciences, etc. Furthermore, commodity names for many economic plants have been added with the following understanding: the common name is used for the product and the taxonomic name for the plant (e.g., APRICOTS for the fruit and PRUNUS ARMENIACA for the plant). Other changes are modifications in the hierarchy of terms, which will result in simpler wordblocks with shorter chains and less poly-hierarchies (i.e., several broader terms to one descriptor).

AGRIS Processing and Output Products

Data are submitted to the AGRIS Processing Unit (APU) on magnetic tapes, cartridges or diskettes, or on input sheets for central processing. Most input centres send their input on diskettes; centres with a large quantity of data use magnetic tapes or cartridges, small countries without computer facilities use input sheets which are typed on ordinary typewriters.

Data are received at APU and merged into computer files. Each reference contains the bibliographic description (title, author, imprint, etc.) and the description of the subject (assignment of subject category codes and index terms). Some centres submit references with abstracts (about 16% of the references). All data are checked by computer for formal correctness. Manual checks are done for spelling errors in English titles and abstracts and for consistency of index terms, subject category codes and titles.

Started in 1975, today the complete AGRIS database contains nearly 1.7 million references. In 1989, the average monthly increment was about 12,000 references. Once a month the checked and corrected data are routed to the production programs, which generate the AGRIS master file. This is the source for the different output products:

- *Agrindex*
- AGRIS output on magnetic tapes or cartridges
- AGRIS CD-ROM
- On-line database

Agrindex

Agrindex is the printed bibliography which is published monthly in three editions: English, French, and Spanish. It contains the main bibliography arranged in subject order and several indexes: e.g., the author index and the subject index.

AGRIS magnetic tape or cartridge

The AGRIS magnetic tapes or cartridges are sent free of charge to all AGRIS participating centres who wish to receive them. Centres use the tapes for retrieval purposes and/or the production of national or specialized bibliographies. The format of the magnetic tapes or cartridges corresponds to the ISO 2709 standard and can be processed on any computer equipped with a tape or cartridge drive.

AGRIS on CD-ROM

In November 1989 AGRIS announced that FAO had concluded an agreement with SilverPlatter Information Ltd. to publish the AGRIS database on CD-ROM. In the first phase the database 1986-1988 and the current disk 1989 to present will be available. The price will be \$700 for the retrospective disk and \$750 for the current disk including quarterly updates. The price for the set will be \$1,350. For developing countries a 50% discount will be granted. Hardware requirements are an IBM PC (or IBM compatible)

with a floppy disk drive and a CD-ROM drive operating under MS-DOS or PC-DOS. A hardcopy printer is recommended but not essential.

About three years of AGRIS will fit onto one CD-ROM disc. Searching the complete AGRIS database will require searching several discs. The advantage of CD-ROM is the fact that neither telecommunication links nor large mainframe computers are required. The time needed to execute a search will have no effect on the cost. CD-ROMs will allow computer searches for centres who up to now had no such possibility.

CD-ROM will be competition for the printed bibliography rather than for the large host computers.

AGRIS on-line on different host computers

Different segments of the AGRIS database are available on many computers in AGRIS participating centres, but only three computers are available through the public telecommunication networks to outside users:

- IAEA (International Atomic Energy Agency, Vienna, Austria) offers the complete AGRIS database as one database (nearly 1.7 million references).
- DIALOG (Palo Alto, California) offers as file 203 the AGRIS database from its beginning, however without the US data. The user will most likely start his search in AGRICOLA, the national agricultural database of the United States, and should not be faced with too many duplicates. DIALOG calls this partial AGRIS database AGRIS INTERNATIONAL. It contains 1.2 million references.
- DIMDI (Deutsches Institut fuer Medizinische Dokumentation und Information, Koeln, F.R. Germany) offers the complete AGRIS database back to 1975 in two segments (AG75 and AG86). Beginning in 1986, the subject category codes were changed and indexing by *AGROVOC* descriptors was introduced. Therefore, DIMDI decided to start a new segment with January 1986.

All three host computers are connected to the world computer networks, to telex and the public telephone. Users in most parts of the world may obtain access to one of the hosts. The IAEA computer is part of the European Space Agency (ESA) network which has a node in Beijing, therefore access to IAEA via ESA is possible from Beijing. The choice of which system to use usually depends on the location of the user, the mode of payment (e.g., AEA bills may be paid in local currency), which other databases are available on the host and are of interest to the user, which retrieval system the user prefers, etc.

The following retrieval languages are in use at the above mentioned hosts: IAEA uses IBM's STAIRS (version 4.2), DIALOG its own system DIALOG (version 21.01.3b) and DIMDI the system DIRS-GRIPS (version 3.08). All three retrieval languages allow rather complicated searches in bibliographical databases. Special mention should be made of the left- and right-hand side and middle truncation at DIMDI, and the middle

and right-hand side truncation of DIALOG. A very useful command at DIMDI is the extract-command, which allows the extraction of other possibly related terms from a set of relevant documents. These terms may be used in a refined query formulation to increase the number of hits. In STAIRS and DIALOG such a feature does not exist. All three hosts implemented the AGRIS database slightly differently, but tests have shown that the retrieval results are identical for the user (except for the fact that the DIALOG database does not contain the US data). The greatest difference lies in the handling of *AGROVOC* descriptors: Whereas in DIMDI thesaurus functions (UP, DOWN, TREE and ALL) exist, DIALOG and IAEA work with a second set of descriptors added to each document reference. This set contains all the broader terms of the descriptors assigned by the indexer. For example, in a document indexed with BEIJING the additional set of descriptors will contain CHINA and ASIA. Therefore, a search on China will also retrieve documents on BEIJING. In DIMDI the same search may be done by broadening the query on CHINA by a search of all its more specific terms, e.g., BEIJING. This broadening of the search is done through the thesaurus function DOWN.

Special Services of AGRIS

AGRIS users may choose to use one of the three host computers and perform their queries via telecommunication access. However, there are AGRIS participating centres that do not have access to the AGRIS CD-ROM or AGRIS online. For such centres, usually in developing countries, the AGRIS Processing Unit offers a free retrieval service. Centres may send letters or telexes with the query formulations to APU, the query will be executed in Vienna and the output will be mailed to the user. The service is free of charge, but is limited to thirty retroactive queries per year per centre. A further facility of APU is an SDI service. SDI (Selective Dissemination of Information) means the monthly execution of a search profile against the newest update of the database. This allows the user to keep abreast of the newest developments in his field of interest. At the present, APU processes nearly 600 retroactive queries annually and some 600 SDI profiles monthly. On request AGRIS users may also receive retrieval output on diskettes or magnetic tapes or cartridges which allow further processing.

Specialized/National Bibliographies

For the time being AGRIS still relies on printed bibliographies. In addition to the monthly editions of *Agrindex*, AGRIS produces several specialized bibliographies. This service is charged to the centre. A query which defines the selection criterion is executed against the online database. The selected references are then routed to a set of computer programs which produce author and subject indexes and prepare the main bibliography and the indexes in a format similar to *Agrindex*. AGRIS prepares the master copy which is then available for offset printing. So far, we have prepared national bibliographies for specific countries (Egypt, Italy, Burkina Faso, etc.) and specialized bibliographies on many different topics (wheat, lentils, beans, new and renewable energy resources, human population in agriculture, forestry, etc.).

System Developments -- Micro-CDS/ISIS for AGRIS.

The implementation of Micro-CDS/ISIS provides a means of preparing and submitting input as well as receiving output. The majority of input centres already send their input on diskette using this database management system for microcomputers. However, a software package was needed for the creation of a national database from which the input for AGRIS could be extracted automatically. To meet this requirement ACC and APU have developed AGRIN, a special AGRIS implementation for national databases. This application should make as simple and straightforward as possible the data entry for a national database and for AGRIS input, including extensive help messages. The package is available in English and French versions, complete with manuals in those languages. Also *AGROVOC* in the form of a Micro-CDS/ISIS database exists and can be installed locally. The development of online input validation for Micro-CDS/ISIS users is well under way and the first package with this capability is now being field tested. It will be ready for general distribution during 1990. It should be noted that AGRIS (and CARIS) have become recognized distributors for the Micro-CDS/ISIS software itself.

The Participation of the People's Republic of China in AGRIS

In 1983 the People's Republic of China became an AGRIS member, with the national AGRIS centre in the Chinese Academy of Agricultural Sciences in Beijing. In 1984 and 1985 Mr. Lebowitz, Head of the AGRIS Coordinating Centre visited Beijing and conducted a three-week seminar for AGRIS input preparation. The AGRIS/CARIS Categorization Scheme (author contract paid by FAO) was translated into Chinese, as well as the Guide to Indexing and the Input Pack (1984 and 1985). In September 1984 the first batch of input sheets was sent to the AGRIS Processing Unit. In September 1985 five delegates from the Chinese Academy of Agricultural Sciences made a study tour and visited AIBA in the Philippines, ACC in Rome and APU in Vienna (under a grant from IDRC). In the summer of 1987 Dr. Chunpei He spent two months at the AGRIS Processing unit (fellowship paid by IDRC) and studied the AGRIS methodology and the AGRIS computer software in detail. As a result of his visit, China's input submission was changed to machine-readable form, using UNESCO's Micro CDS/ISIS database management system.

The input statistics for China are as follows: starting with 157 references in 1984 and continually increasing their annual submission (557, 1,443, 1,628, 1,986), China reached 3,458 references in 1989. Since August 1985 the Chinese AGRIS centre has been receiving the monthly AGRIS magnetic tapes in order to process them for local needs.

The participation of China in AGRIS cannot be compared with most of the other AGRIS participating centres. Transliteration of author names and transliteration of titles imposed severe problems at the beginning. During the first years of China's participation original titles in transliterated form were entered into the database. This feature was then dropped as AGRIS users as well as the Chinese liaison officer questioned the usefulness of these data elements.

The increase in the input statistics looks promising, and it is assumed that in the coming years China's contribution will continue to grow. Therefore the present contribution should be considered more a pilot project than full production.

Ten Years' Progress in China's Computerized Information Retrieval and Its Future (Abridged)*

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Abstract

The development of China's computerized information retrieval in the past decade is reviewed and divided into three distinct stages, namely exploration, basic construction and moving toward implementation. Major technical advances in ten areas are outlined, along with a brief discussion of main lessons and shortcomings. In response to expected developments in the coming decade, new goals are listed to include three main directions. Major tasks of concerned areas to achieve these goals are also outlined.

1. Progress In China's Computerized Information Retrieval

1.1 Brief History

The development of computerized information retrieval in China over the last decade can be divided into three distinct stages:

1) Exploration Stage (prior to the middle of the 1980s)

The following works and studies were made which focused on demonstrations and experiments of computerized information retrieval systems:

- Development of SDI systems based on foreign bibliographic tapes;
- Preparation for setting up retrieval systems;
- Initiation of international online information retrieval services;
- Theoretical studies on information retrieval;
- Research of information retrieval software;
- Experiments on microcomputer applications.

According to 1985 statistics, information institutions at all levels have a total of about 60 large, medium, or minicomputers as well as 900 microcomputers.

- This paper was abridged from a keynote address which was made by the author at the 7th Symposium on Computer-based Information Retrieval in China, in his capacity as the head of the Computer-based Management Committee of the China Society for Scientific and Technical Information.

2) Basic Construction (from the mid-1980s to 1987)

Computerized information retrieval systems and database construction began to achieve great progress along with the popularization of Chinese character processing microcomputer systems. The following were accomplished:

- Thirty computerized information retrieval systems had been established;
- User terminals of the international online services had been set up in fourteen cities, with an estimated total of 3,000 searches per year;
- Experiments and applications of microcomputers had sprung up all over the field of library and information services;
- A number of personnel were trained and brought up in the development and maintenance of information retrieval systems;
- The start and development of Chinese database creation.

3) Moving toward Applications (from 1987 to present)

With the achievements of the second stage as a foundation, the national computerized information retrieval system for scientific and technical information, as the key project of the 'Seventh Five Year Plan,' began to be formed and achieved noticeable progress. Following are the major works covered:

- A number of important bibliographic databases have been built domestically and made available to the public;
- Development of retrieval software capable of processing Chinese character information on mainframes and microcomputers;
- Research on supporting techniques for bibliographic database retrieval, such as automatic indexing and machine translation;
- More than 104 computer systems have been installed for applications in information retrieval and library automation, of which nearly twenty information systems have the capability of creating databases, retrieving information and editing publications, and a few of which have a remote online retrieval function;
- Hundreds of microcomputers have been installed in various information institutions and over 100 microcomputer-based application packages have been designed;
- About seventy foreign commercially available databases, in addition to about forty CD-ROM databases, were imported, with a total of 30,000,000 records, of which about 10,000,000 records were downloaded into the systems;
- Over eighty user terminals to access international databases have been installed in some thirty cities;

- Nearly 300 bibliographic, textual and numeric databases in Chinese characters were created, and domestically-created bibliographic databases contain about 600,000 records;
- Thirty thesauri were compiled, and nearly thirty national documentation standards were developed and implemented;
- Over 4,000 professionals were engaged in the development and maintenance of information retrieval systems and databases, nearly 100 Master of Science degrees in the field of computerized information retrieval were awarded.
- Seven national and two international symposia on computerized information retrieval have been held in the 1980s. The total number of papers presented is 682, and the number of authors and participants for all the symposia total about 580 and close to 1,000 respectively.

1.2 Technical Advancements in Ten Areas

1) Computer-aided thesaurus compilation

Since 1980, more than sixty thesauri have been compiled. Over half of which are in machine-readable form. Most computer-based thesaurus management systems have been designed with only the simple functions of inputting, index editing and printing. Only a few systems have functions like automatic checking of interrelations between terms, automatic reference creation, and daily maintenance and updating.

2) Automatic indexing and Chinese word segmentation and extraction

A variety of methods based on dictionaries or Chinese morphemes have been invented. Some experimental systems have been operating satisfactorily.

3) Database creation and services

About 300 bibliographic, textual, and numeric databases have been created. Of the 219 abstracting and indexing journals in printed form, twelve have been compiled and printed by computer and are available in machine-readable media.

4) Information retrieval software development

Many retrieval packages such as MINISIS, TRIP, DATATRIEVE, and CDS/ISIS have been modified to be able to process Chinese scripts. More retrieval software has been developed independently on large, medium, mini and microcomputers. BDSIRS, developed at BDS, is an English/Chinese compatible online information retrieval application package.

5) Theoretical studies on information retrieval

Information retrieval models based on probability and fuzzy theory have been put forward. A number of papers covering systems appraisal, quantitative analysis of retrieval efficiency, etc., have been presented at almost every symposium.

6) Domestic online information retrieval

BDS is now operating an online information retrieval system with sixty remote online terminals in twenty cities across the country and a total of 7,000,000 bibliographic records. An online scientech information retrieval network which provides public online service via dedicated or dial-up telephone lines in Shanghai and nearby districts has recently become operational.

7) International online information services

Over eighty user terminals have been installed in some thirty cities, which link with eleven major world information retrieval services, including DIALOG, ORBIT, STN, ESA/IRS, BRS, DMS/DRI, ECHO, INIS, WRS, MEDLINE, Pergaman-Infoline.

8) Machine Translation

Several experimental English/Chinese machine translation systems are being developed in some information institutions such as ISTIC and BDS. The accuracy of translation has reportedly reached 70%-80%.

9) Library automation

Nearly fifty computerized library automation projects have been reported, over two-thirds of which are under way in colleges and universities. Integrated library automation systems have been developed in different modes, either on minicomputers, like the HP 3000 series or on local area networks of microcomputers.

10) CD-ROM applications

Over forty CD-ROM databases have been imported, many of which are owned by small information units. Research on WORM and electronic publications has also made progress.

1.3 Main Problems

China's computerized information retrieval has taken a promising step forward in the expected direction but is still far away from its application destination, and there are many pending problems to solve in the attainment of the established goals.

Most of the established computerized information retrieval systems emphasize the construction of computer systems but not the utilization of information;

- Various information systems are blockaded from one another and are likely to proceed in their own way;
- Computers, telecommunications, and databases have not developed at the same pace and in good coordination to become the three most important links of processing, dissemination and storage in the information chain.
- Macro management mechanisms like planning, legislating, policy-making, and funding for information systems development and database creation is relatively weak.

2. Prospect of China's Computerized Information Retrieval for the 1990s

2.1 Technological Environment

The development of information technology is the vital force in the modernization of scientific and technical information services. In the near future of the 1990s, progress in the three areas of micro-electronics, high density storage, and data communication, particularly the combination of computer processing and communication technology, will greatly expedite the modernization of scientech information services.

- High performance microcomputers
- A variety of input techniques such as graphics and voice recognition
- New types of storage media such as CD-ROM, WORM and hologram
- Work stations and LANs
- Public switching data communications, IDS and ISDN
- Artificial intelligence technology such as expert systems, NLP

2.2 New Goals and Tasks

1) New Goals

In the 1990s, China's computerized information retrieval should attain several overall achievements. These include the following:

- Overall realization of information services whose operations are based on databases, computers and telecommunications;
- Overall automation of library and information processing;
- Establishment of innovative information enterprises to acquire, organize and disseminate information utilizing emerging information technology on a self-developed basis.

2) Main Tasks

- Database creation

- national database system, integration of machine-readable databases and indexing journals, utilization and effectiveness studies, innovative databases, international database exchange.
- Information supplying and utilizing technology
 - products and services facing special users, transfer between different media, structure and mechanism for the information industry, innovative information products and services, marketing studies.
- Information processing automation
 - computerized lexical management system, automatic Chinese word segmentation and extraction, automatic indexing and classifying, automatic input techniques, machine translation system.
- Retrieval techniques
 - innovative information retrieval system design, modern user interfaces, intelligent terminal/workstation, multi-thesauri/languages conversion and interface.
- Communications and network construction
 - LAN and networking between LANs, networking between main national systems through national public data network, international networking, innovative video/data broadcasting information system.
- Library automation
 - popularization and perfection of microcomputer application, research and popularization of integrated library management system, computerized united catalogues, library networking.
- CD-ROM application and research
 - importing and popularizing CD-ROM products, comprehensive utilization of CD-ROM, WORM based electronic publication, national CD-ROM based database.
- Soft environment construction for overall plan and management
 - medium/long term development programs and policies, system structure and operating mechanism for information system, organization of industry-type database creation and service, countermove studies on data security, information pollution and computer viruses.
- Studies on theories of relevant disciplines
 - research on new fields of information retrieval theory, intelligent information system based on hypertext and knowledge bases, philosophy and mathematical models of information retrieval.
- Basic construction

- overall standardization of information processing, output/publishing system, high performance application packages for information professionals, education methods and technology for personnel training.

A Brief Introduction to the Computerized Agricultural Information Retrieval Systems in China

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Abstract

The author briefly introduces the agricultural information retrieval systems in China with emphasis on the computerized information systems at the national centre. AGRIS and CABI are the two main foreign databases with which the national centre provides services for users in China. Meanwhile the national centre is now concentrating its efforts on establishing Chinese language databases which will open up a new era in agricultural information retrieval and dissemination systems in China.

Along with the continuous development of new technology and its application in the sector of library and information, the orientation and tasks of information organizations have made great changes. Since the 1970s, information organizations have begun to change and transfer to industrialization. In addition to the publication of traditional index journals, these information organizations have begun to develop various types of databases. On the other hand, in accordance with the needs of society, libraries have begun to develop and process various condensed information products and provide computer retrieval services in addition to the traditional work of simply collecting and reporting the library's collection.

The Status of System Development

Today, the volume of information and documents is increasing in dramatic proportions, the number of information services is increasing day by day and the information enterprises for the information society are taking shape. In the field of agricultural information, are a lot of large-scale databases such as CABI, AGRIS, AGRICOLA, BIOSIS, etc. At present, many agricultural databases in the Chinese language are now just beginning to be established. A computerized information retrieval system has been established at the Sciencetech Documentation and Information Centre, Chinese Academy of Agricultural Sciences with a combination of minicomputers and microcomputers. This system has played an important role in the formation of a nation-wide agricultural information retrieval system.

This agricultural information retrieval system was established in 1987 through the kind donations of IDRC and with some self-raised funds at the Sciencetech Documentation and Information Centre, CAAS. This system is the national focal point for providing modernized access to services for users throughout China.

1. The Organizational Structure of the System

Organizationally, the system is composed of the computers of the Sciencetech Documentation and Information Centre, CAAS, seven regional subcentres, agricultural information centres at the provincial level, information centres of agricultural universities, and professional institutes. Based on volunteer efforts for mutual benefit, the whole system can provide multi-layered information retrieval services on the basis of region and profession. At present, a data transfer network has been established among the national centre and the seven regional subcentres. (Figure 1.)

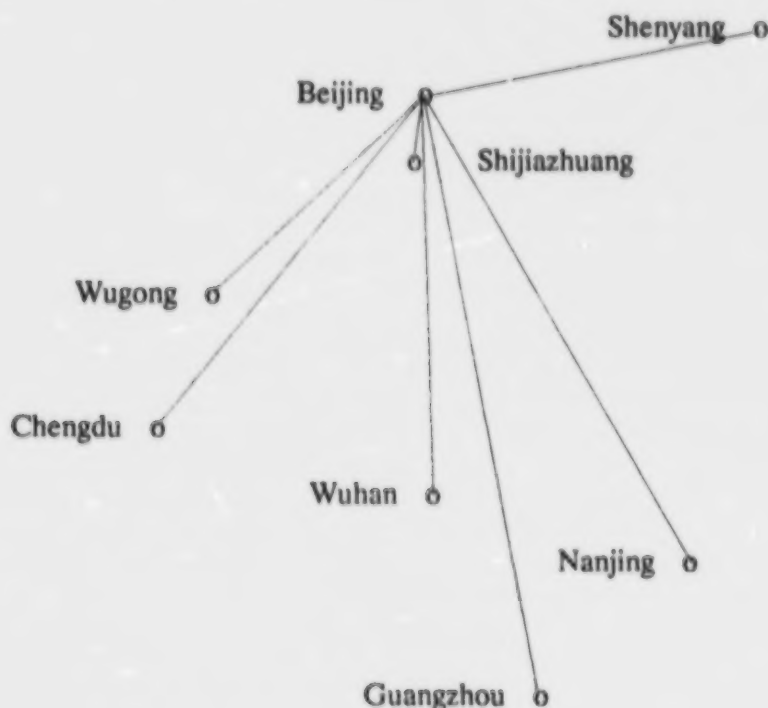


Figure 1.

2. Hardware Composition

Due to a requirement for heavy use and providing broad service, the national centre has been equipped with HP3000/37 and HP3000/70 minicomputers which have fairly strong functionality. Each of these two systems is equipped with its own tape drive, line-printer, disk drive and other input and output equipment. (Figure 2.) The HP3000/37 is mainly used for the establishment of the AGRIS database while the HP3000/70 is used for the establishment of Chinese language databases as well as for an SDI service on the CABI database. In addition, the national centre is also equipped with various types of microcomputers for the convenience of data transfer between the national centre and the seven regional subcentres. Of course, these microcomputers

are mainly IBM and its compatibles. At present each of the seven regional subcentres has already been equipped with an IBM PS/II 50 through a kind donation by IDRC.

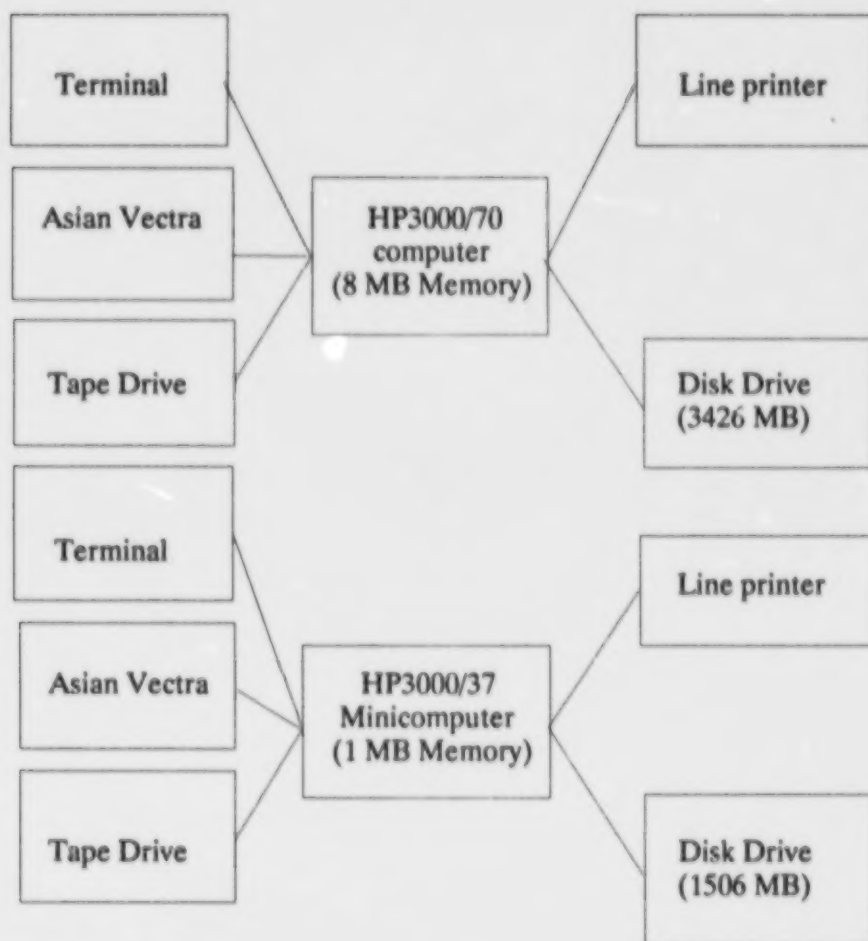


Figure 2.

3. Software Composition

The HP3000 minicomputer systems equipped at the national centre use MINISIS DBMS which is developed and kindly provided free of charge by IDRC for the establishment of computerized databases and retrieval services. The microcomputers equipped at the regional subcentres use Micro CDS/ISIS DBMS which was developed by UNESCO for the establishment of databases and retrieval services locally. Due to the high compatibility between MINISIS and Micro CDS/ISIS, the data transfer between the national centre and the seven regional centres are realized via ISO 2709 format. (Figure 3.)

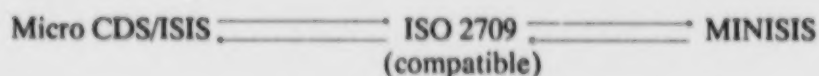


Figure 3.

4. Composition of Databases

A retrospective AGRIS database has been established in the HP3000/37 minicomputer system. The SDI service of CABI and AGRIS has been created in the HP3000/70 minicomputer system. (Figure 4.)

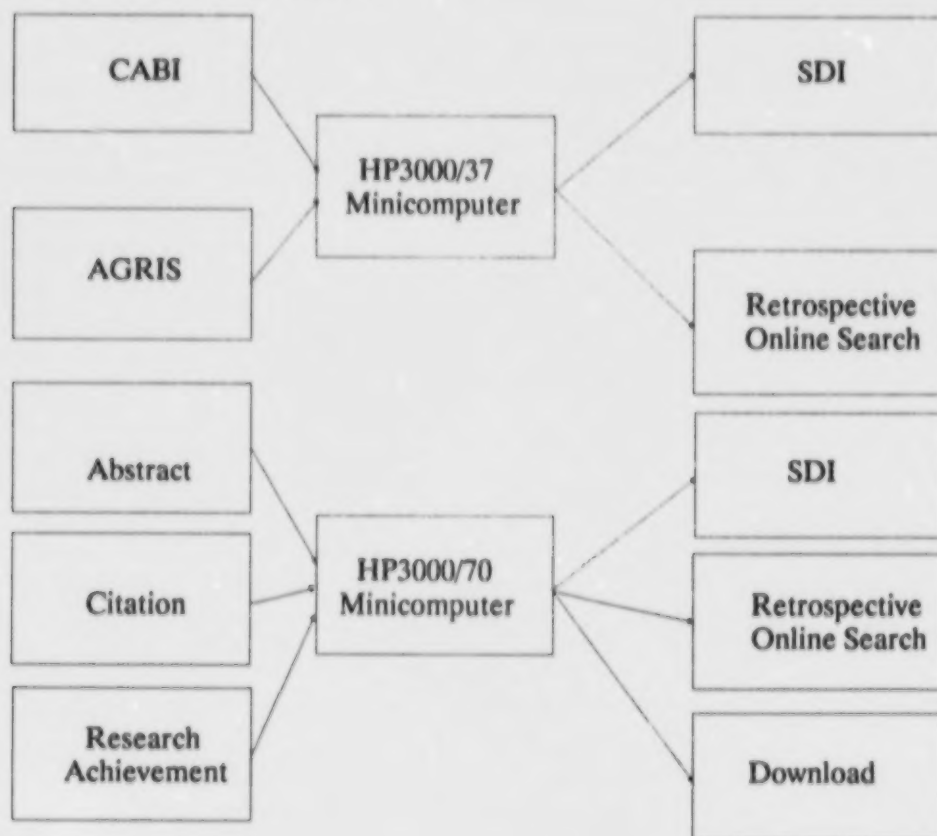


Figure 4.

The Chinese agricultural databases now being established include: Chinese Agricultural Abstracts, Comprehensive Agricultural Citations, Research Achievements, etc.

5. Structure of Online Search Networks

The computer retrieval system of the national centre in Beijing utilizes the state data networks to unfold online searching services. The regional subcentres which possess the required equipment can make use of the national communication (telephone)

networks for their online search services. During online searching, one can use IBM or compatible microcomputers to search the databases of CABI, AGRIS, and other Chinese databases established at the national centre via "HZ2392A" software. The modem used for this purpose can have a transmission rate of 300-2400 baud. (Figure 5.)

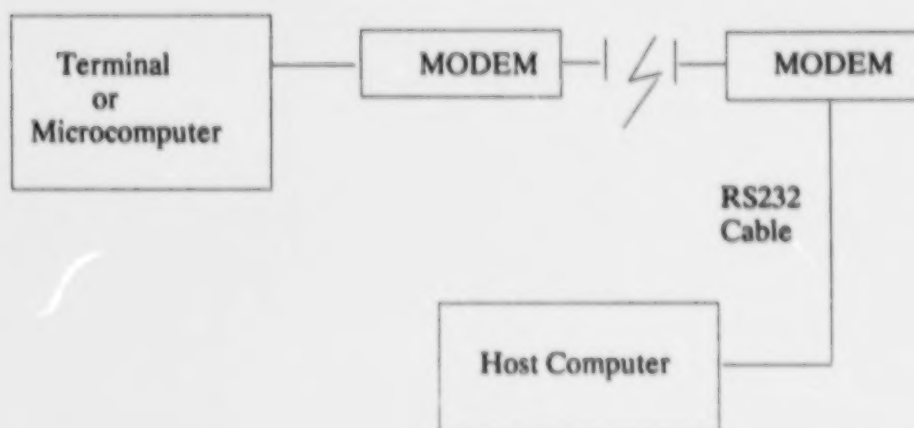


Figure 5.

6. The Production Flow of the System

The national centre receives CABI and AGRIS tapes every month and establishes SDI databases on the HP3000 minicomputer. The SDI database of AGRIS is then transferred into the retrospective database.

The establishment of the databases in Chinese language is done on microcomputers via DBMS of Micro CDS/ISIS. This is because it is very convenient to input data on microcomputers as an independent work station. In so doing, we can save a lot of electricity by shutting down the HP3000 minicomputer when unneeded. The data which have been input into microcomputers can first be proof-read and corrected and then transferred into ISO2709 format. Finally, the data can be loaded into the HP3000 minicomputer system by establishing the database on MINISIS.

7. Output

(1) Coordinated Process of Editing and Typesetting:

The output products of the whole system include floppy disks, tapes, and journal forms. In addition to the online searching and offline searching services provided by the HP3000 minicomputer, "Keyin" editing and typesetting software is used to format journals for printing. We have realized the operation of using the input data to establish databases and also to print journals for the Chinese databases such as the Comprehensive Agricultural Citations, Chinese Agricultural Abstracts and Research Achievements. The coordinated process of editing and typesetting is done by first converting the input data into a text file and then producing the typesetting form by using "Keyin"

typesetting software. The final product of the typesetting is then used for printing journals. (Figure 6.)

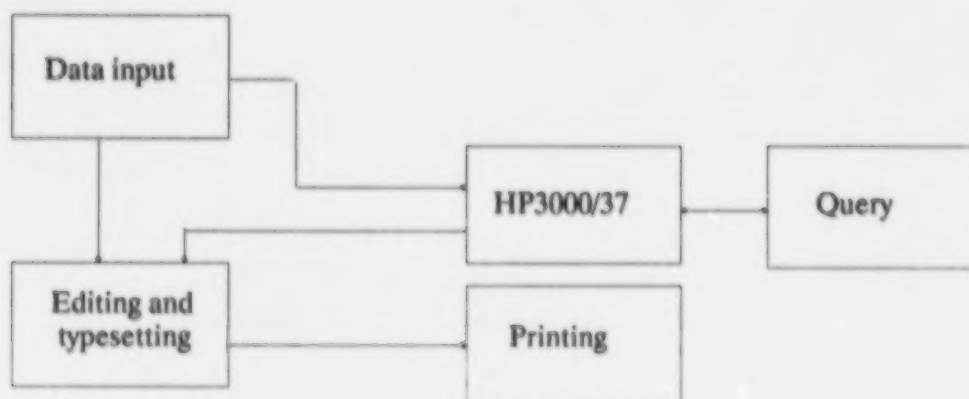


Figure 6.

(2) Download Service:

This system will soon start its downloading service for the seven regional subcentres. All the centres which are equipped with IBM PCs or compatibles running Micro CDS/ISIS can take advantage in the downloading service from the national centre. The national centre will provide regional subcentres with AGRIS data in ISO 2709 format on floppy disks if requested with a subject specialization and range of years.

(3) SDI and Retrospective Retrieval Services:

At present, the national centre already provides SDI services on the CABI and AGRIS databases for users country-wide. A retrospective database of AGRIS has also been established which can trace information back to 1985 and the retrieval service on AGRIS has already been welcomed by many users though it started its service just recently.

(4) Sending Floppy Disks of Chinese Agricultural Citations to the AGRIS Processing Unit:

The national centre is coordinating the work of collecting, translating and indexing Chinese agricultural documents in cooperation with the seven regional subcentres. The input of these records is done individually at each centre and the national centre is responsible for the review, quality control, and merging of these records. Every two or three months, the national centre will convert these data from WordStar format into text files and send the data on floppy disks to the APU in Vienna. The data will be loaded into the IBM mainframe in Vienna to join the international AGRIS database. China sent 4,500 citation records to APU for the year of 1989 and the estimate for 1990 is that we will reach 6,000 citation records.

Development Trend of the System

By the year 2000, the national centre will still play the role of national focal point and will continue to provide retrieval services for users throughout the country. By that time, the whole system will be divided into two computer subsystems: one for database retrieval and the other for national library automation networks.

The latter will not only provide information which reflects the library's collections but also provide services of nation-wide inter-library loan for users throughout the country.

It is planned to expand the external memory of these two computer systems to 11,000 MB provided we can secure enough funds. Meanwhile the communication between the two systems will be solved. In addition, the national centre will also conduct research on compression technology on foreign language databases so as to fully utilize the existing external memory of the computers and provide even better and faster services.

In the database retrieval system, the Chinese databases will include Comprehensive Agricultural Citations, Chinese Agricultural Abstracts, Research Achievements, Current Agricultural Research Information and other textual and numerical databases. The first two databases will include 1 million and 150 thousand records respectively by the year 2000.

The foreign language database will include CABI and AGRIS. In addition to an SDI database, AGRIS will contain approximately 1.5 million records in the retrospective database by the year 2000. As for CABI, the national centre will maintain an SDI database for users throughout China.

By the year 2000, it is planned to establish regional information retrieval systems in addition to the online search services provided by the national centre. Overall resource sharing will be realized between the national centre and regional subcentres. The computer system of the national centre will only load databases of national significance for users of the whole country. The regional subcentres are encouraged to establish various types of databases suitable for their local agricultural production and research. The national centre will continue to play the role of coordinator for the whole country to let each centre be able to search either the database at the national centre or databases at other regional centres. The regional subcentres will continue to provide agricultural scientech information from local publications for the national centre.

The national centre will also provide technical services for the regional centres or centres at agricultural colleges and universities. These services include sending floppy disks, tapes, CD-ROMs, WORMs, etc. When conditions are ripe, it is planned to set up international online terminals for access to DIALOG of USA, ESA/IRS of Europe, or other international online searching services so as to provide even better and more comprehensive services for the users throughout China.

Efficient Architecture and Development Strategy of Agricultural Information Systems in Developing Countries

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Abstract

Information on agricultural production, the economy, and science and technology should be considered major components of agricultural information work. Levels of production in developing countries are usually rather low. The lower the level, the greater the restraint that agriculture places on the national economy. The key task for developing countries is to enhance the agricultural information services for the realization of agricultural modernization. The author proposes ten points in respect to the development of a strategy for agricultural information work, i.e., rectification of the guiding principles; determination of the strategic objectives; reinforcement for a perfect agricultural information system; rational assignment of tasks and forces to information institutions at different levels; quick response to users whose demands are constantly studied by institutions concerned; stressing the modernization of information means; strengthening the establishment of a contingent of agricultural information specialists; enhancement of scientific research for agricultural information, reinforcement of international exchange and cooperation; and adoption of laws for developing the cause for agricultural information.

The levels of production are generally low in developing countries; the lower the level, the greater the restraint that agriculture places on the national economy.

Agricultural information is actually the activated knowledge of agriculture. Agricultural information work plays an important role in the modernization of agriculture in developing countries.

As to the efficient architecture of an agricultural information system in developing countries, the following factors should be taken into consideration:

First of all, agricultural knowledge must be provided in efficient ways. Agriculture deals with four aspects of knowledge, namely: agrobiological, agricultural environment, agricultural techniques and agricultural economics.

Next, features of agriculture in developing countries must be reflected appropriately. Most of the agricultural production is performed by hand. Agriculture in developing

countries is characterized by its monotony in structure, its low commodity rates for products and its deteriorated ecological environment.

Finally, users must be satisfied with information they receive. The major users of information are policy-makers from different levels of the government, staff from different agricultural institutions and those who themselves engage in agricultural production.

An agricultural information system with an efficient architecture must be built on the basis of the agricultural features of a particular country, aiming at the existing and potential demand of the information users and converting the information concerned into a productive force by effectively providing the users with particular information. The chief components of information work should be agricultural science and technology, production and economic information. Regional and professional establishments for information services can be organized with each having its own emphasis and closely cooperating with others to serve the common goal of realizing agricultural modernization.

Development strategy of agricultural information work chiefly deals with the problems of long-term projects. It is the outline of integral design that guides a sound development of agricultural information work. The following tentative proposition is made by the author, concerning a strategy for the development of agricultural information work in developing countries:

1. Rectification of the guiding principles. The value of information must be recognized and agricultural information work given sufficient stress. Agricultural information service is not a profitable enterprise. It should be regarded as one of the public services supported by the government.

2. Determination of the strategic objectives. The chief purpose of agriculture is to regulate the relationships between the human race and other living beings, and their environment, and to provide people with agricultural products, high in yield, quality and utility and low in cost. In China, efficient utilization of natural resources, effective maintenance of stable ecosystems, and strict control of the birth rate are considered the three major premises to promote agricultural production and reform rural living conditions. Probably, these premises could be a meaningful reference for other developing countries. A steady increase in agricultural production, raising people's consumption level of agricultural products and improving the environment must be kept in mind when strategic objectives are being determined.

Library management, informative investigation and exploitation are major aspects of information work. In accordance with the principles of "seeking truth from facts," overall planning and all-around considerations, and advancing step by step, the integral design could be worked out to present definite objectives. In the meantime, experiences from other countries must be studied and absorbed by specialized staffs, with the

foreign experiences combined with the reality of the local country in order to hasten the development of agricultural information service.

3. Reinforcement for a perfect agricultural information system. An agricultural information center should be set up by the state in order to centralize the leadership and coordinate the work nationwide. Under this national center, there should be regional and professional establishments, with the regions divided into provincial and county-level information institutions and the professional entities into plant and animal production information institutions. The regional and the professional institutions should be developed in a coexisting and coordinated way.

Additionally, agricultural information organizations run by the people should also be encouraged.

4. Rational assignment of tasks and forces to information institutions at different levels. The national center of agricultural information should serve the whole country, providing it with information about the existing levels and trends of agricultural production at home and abroad, study strategic subjects of agricultural development in the whole country, and organize exploiting programs of agricultural information that would influence the whole country. As to the institutions at the provincial or prefectural level, in addition to accepting the coordinate tasks assigned by the national center, they have to closely study their local situation and problems and offer appropriate information services. The regional institutions should make a special effort to carry out synthetic services, and the professional institutions professional services.

Sufficient personnel, resources and financial support must be provided to ensure the fulfillment of the tasks, and the government is duty-bound to offer this support.

5. Quick response to the users whose demands are constantly studied by the institutions concerned. Since information is demanded by users, information services would be valueless without users. The users' demands consist of two aspects, i.e., the demand for macroscopic policy-making and the demand for microscopic decision-making. Predictive information must be promptly provided based on a study of inherent relationships of causes and effects that change with time, place and situation. The reliability of the prediction comes from the precise systematic investigation of the users' demands. The chief yardstick to measure the efficiency of information work is the number of users and the degree of their satisfaction.

6. Stressing modernization of the information process. It is required for the information service to shorten the time which the user takes to get what he needs. For this reason, modernized facilities for collecting, storing, searching and transmitting information must be employed as much as possible. Since finances in developing countries is limited, although the extensive establishment of small specialized databases may be possible, it is difficult to attain searching with remote terminals. Over the years, the presence of CD-ROM manifests that information can be rapidly searched with a

computer without the need for electronic communication facilities. This is an economical and effective approach for the development of information work.

It is quite important for developing countries to pay much attention to the exploitation and application of CD-ROM.

7. Strengthening the establishment of a contingent of agricultural information specialists. Agricultural information bachelors, masters and doctorates should be trained in universities under a definite plan. Simultaneously, on-duty personnel should be trained to renew their knowledge and strengthen their ability.

8. Enhancement of scientific research for agricultural information. As agriculture is greatly influenced by natural elements, agricultural information work also has its own features, governing rules, lessons from practice which must be learned and summarized continually, and the practical materials must be sublimed to theories in order to guide the advancement of the work.

9. Reinforcement of international exchange and cooperation. Developing countries have their own areas of superiority. On the basis of independence, self-reliance, equality and mutual benefit, the international exchange and cooperation can be smoothly carried out, which contributes a lot to international information circulation and the sharing of information resources. Efforts must be exerted in two directions, in order to reinforce international exchange and cooperation. Problems of common interest should be studied in a cooperative way in order to jointly exploit the information resources.

10. Adoption of laws for developing the cause of agricultural information. In order to promote the advance of agricultural information work, support and projects from the government must be ascertained in form of laws.

The way out for agriculture is its modernisation which calls for enhancement of the information work.

The Infusion of Quality in Agricultural Information Services

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INTRODUCTION

Analysis of user need surveys in a wide variety of fields bear out quite clearly that libraries and information services rank low in the order of information sources sought when a user is in need of information. This state of affairs is probably due to the failure of libraries/information services to provide services or products that satisfy the needs and expectations of their clientele. Quality can be defined as "a judgement by customers or users of a product or service." Thus one can interpret quality to mean that it is "the extent to which the customers or users believe the product or service surpasses their needs and expectations." Libraries and information services therefore should continuously review their products and services to keep them in line with the needs of their users if they are to justify their existence in the light of other competing services or priorities. In this regard the need to infuse quality in the processes that lead to the development of relevant information products and services cannot be too strongly emphasized.

QUALITY

The notion of quality is difficult to define. It is seen as an ideal to which one should aspire but which exists in the realm of the impossible. However, contrary to normal assumptions, the infusion of quality in any endeavor is possible, provided there is willingness to make the necessary effort. In that sense quality is free. The erroneous assumption that quality means "goodness" or "luxury" or signifies a relative value must be obliterated. Quality is conformance to a set of requirements which must be specified. Arguments that quality is immeasurable and therefore cannot be specified, confuse our understanding of the word quality. Quality is measurable. In commercial circles quality is measured by the profits you make. When a general observation or evaluation is made that a process or thing possesses quality, the judgement that has been made is weighed against certain expectations or requirements. This implies therefore that, given further analysis and thought, specifications on the quality expected of a thing or process can be made.

Another way of measuring quality or at least making a judgement on it is to study the cost of doing things wrong. There must be a realization that doing things the wrong way implies the redoing of it which is wasteful and unnecessarily costly. In other words it was done at the expense of nonconformance. This underscores the concept of doing things right the first time. There must be sufficient thought given to a process before it is undertaken. Aspects of planning are inherent. Questions like: "What is to be done?";

"Why should it be done?"; "How should you do it?"; and "What are the requirements to be satisfied?" will help as guides to conformance and therefore to doing things right the first time.

There is also another erroneous assumption about the economics of quality. The attitude that the least effort and cost to produce a product or execute a process is cost effective is wrong. What is essential in quality is that the product or process possess appropriate measures of quality through a system that certifies this measure. Problems of quality are not just those originated by the workers or operators of a process or product. They may be due also to defects at all levels of top and middle management. Quality therefore is the joint responsibility of all staff.

THE NEED FOR QUALITY

The assurance of quality in an organization is dependent on quality management which may be defined as a systematic way of guaranteeing that organized activities happen the way they are planned. It is a management discipline concerned with preventing problems from occurring by creating attitudes and controls that make prevention possible. Management must therefore recognize that quality is a positive management tool.

In addition to paying attention to matters considered internal to the organization, quality management also encompasses due attention being paid to the relationship of the organization to its environment--the parent body it serves and other persons or organizations with which it has to work. Clientele needs have to be monitored. It must be realized that user satisfaction is the ultimate goal of any information agency. The user therefore is the most important element in the environment in which an information service operates. There is a need for a continuing process to determine how its products and services are performing and what new characteristics would increase user satisfaction.

Maintaining an information service with all its trappings is an expensive affair. In the harsh economic climate that many organizations face, the information service has to compete with other services and priorities of the organization for resources. The infusion of quality therefore in information services will be invaluable in convincing management that a well supported information service is an asset to the organization. Taking heed of this, managers of information services must realize that the cost of quality is at the expense of doing things wrong. Things done wrong in an organization may be avoided or minimized if management plays its appropriate role. Management is the function responsible for establishing the purpose of an organization, determining measurable objectives and taking the actions necessary to accomplish those objectives. It should be realized that the further an administrator gets from the administered the less efficient the administration becomes. The infusion of quality in an organization therefore, requires a commitment and involvement from management, which must be convinced that a quality infusion program implemented over a period of time will ensure eventual success.

QUALITY IN INFORMATION SERVICES

Users of library and information services have suffered from decades of negligence. We have yet to establish a continuing process that monitors users' needs and determines how our products and services are used and received. It is timely therefore to focus our energies and quality infusion programs on the following:

- a. The conduct of regular research on users and their needs and expectations with a view to the determination of appropriate, product or service concepts that would satisfy users.
- b. A user response analysis of information collected as a result of constant interactions with the user so as to understand better the performance of products and services and to effect any necessary changes on them.
- c. The planning and design of information products and services to ensure that design specifications comply with user needs.
- d. Ensuring that the process of producing the product or offering a service is in accordance with the design specifications. This is sometimes referred to as conformance.
- e. Ensuring the maintenance of uniformity of the quality characteristic of goods and services.

QUALITY INFUSION PROGRAM

It is proposed that information systems launch quality infusion programs on a planned basis to be monitored regularly. Since it takes time to change the attitude and habits of an entire organization, such a program may have to be consistently implemented for a number of years before the fruits of such an exercise become apparent. Major elements of a quality infusion program include the following:

- Management commitment
- Quality improvement team
- Adoption of new philosophy
- Quality measures
- Quality awareness
- Education and training
- Supervision
- Instilling pride in work
- Removal of negative barriers

- Restructuring
- Recognition

Management Commitment

If it is to be expected that staff at all levels are to follow the program, the role of management in its implementation is paramount. Leadership must be by example. Management commitment by personal participation "raises the level of visibility for quality and ensures everyone's cooperation..."

Quality Improvement Team

The establishment of a quality improvement team by management comprising representatives of departments will ensure the involvement of a cross-section of the organization. After having been briefed on the content and purpose of the program the team should be given a reasonably free hand to carry out their tasks. In this way operations and processes on a departmental and organization wide basis may be coordinated and improved upon.

Adoption of New Philosophy

The preparation of a quality policy by management will help set the broad direction for all. There must be promotion of quality consciousness among staff at all levels. All staff must actively "reject commonly accepted levels of defects, rework, shoddy workmanship and poor service." There must be a deliberate attempt towards defect detection followed by a defect prevention mechanism. Wide publicity of such a philosophy will ensure quality consciousness among all staff.

Quality Measures

Staff will conform to the requirements of a job if the job specifications are well spelled out. Therefore it is necessary to determine the quality measurements for each area of activity. The status of quality throughout the organization thus gets determined. Subsequently corrective action can be taken as and when necessary. It must be emphasized that quality measures should not be confused with numerical goals and work standards, which should be avoided.

Education and Training

The staff of an organization constitutes one of its most important assets. They have a need to understand the relationship of the work they do to that carried out in the rest of the organization. Their success in conformance to specifications means that they must be trained adequately to satisfactorily perform their function. Training must be regarded as an ongoing integrated process necessary in a successful organization. Staff motivation and morale take a higher plane when training programs are put in place.

Supervision

Supervision is a critical link between top management and its employees. "Supervision must be a supportive, positive endeavour that encourages learning, development, problem solving, trust and change by advancing training, removing barriers, fostering

pride in work, showing workers how they fit in---and stressing quality." The need for good supervisors is crucial in the promotion of team work and in improving the ability of staff to carry out their functions.

Instilling Pride in Work

Pride provides the impetus to perform better and to improve quality. It is poor management that is to blame if a worker lacks pride in his job. Factors that contribute to loss of pride in workmanship are many. Some of them are stated below:

- a. Managers pay too little attention to the problems of workers.
- b. Workers are confused, uninvolved and under-utilized if they do not understand the organization's objectives or goals and therefore do not identify with the organization.
- c. Workers are always blamed for system failures and the organization's problems.
- d. Inadequate training and low levels of supervision.
- e. Poor systems planning, faulty equipment and unwieldy methods add to the development of uninvolved and lack of concern.

If workers are robbed of their pride in workmanship and are treated as commodities then their full potential cannot be realized---an expensive loss to the organization.

Removal of Negative Barriers

Every organization during its period of growth and development is likely to face obstacles which could hinder its progress. Recognition of these barriers with the purpose of eliminating them or reducing their effect is a good first step. Good communication which is multidirectional, vertical and horizontal is essential in any organization if matters such as competition, differences of opinion, personal grudges, differing priorities and departmental barriers are to be minimized. The oneness of an organization encouraged by teamwork will go a long way toward effective cooperation and positive attitudes in the work place.

Restructuring

Any deliberate attempt to infuse quality in an organization will eventually necessitate the reorganization and transformation of the organization as a response to changes that will take place. The new organizational environment that will eventually evolve is the responsibility of management. The change in the philosophy of the organization and its culture will have at its apex the need to constantly improve every aspect of the organization.

CONCLUSION

There is an urgent need for all of us in the information world to rethink and rationalize our objectives in the context of this fast changing world. We cannot afford to continue

doing what was done decades ago. If there has been a change in the way we do things today it is to do them better but we are still essentially performing the same functions. The environment to which we have to respond has changed and is in a continuous state of flux. Our challenge is to be aware of our environment, determine the options of how to respond, take stock of the resources at our disposal, plan and implement our products and services with one major objective in mind--to more than satisfy user needs and expectations. The infusion of quality in such a program coupled with process improvement will doubtless witness a revolution in the information industry.

Access Points to the Database of Bibliographies of Agricultural Documents in China and Their Retrieval Functions

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Abstract

The Database of Bibliographies of Agricultural Documents in China is an information retrieval system for storing the information concerning agricultural sciences in the Chinese language. It merges the creation of the database and editing and typesetting into an organic whole. Formation of the index entries uses nine function symbols to control the layout of access points and the logical relationships among the descriptors. There are 33 fields for each record, thirteen retrieval fields, eight indexes and 22 tail marks, 137 codes in the subject category index and 92 terms for retrieval concepts in the database. They can be combined with each other in retrieving and it is an effective information retrieval system that once "the headrope of a fishing net is pulled up, all its meshes open."

The Database of Bibliographies of Agricultural Documents in China is an information retrieval system for storing specific information concerning agricultural sciences in the Chinese language. It merges the creation of the database and editing and typesetting into an organic whole. Now we are using a computer system to edit and typeset hard copy of *Bibliographies of Literature in Agricultural Science and Technology in the Chinese Language* and benefit greatly from the system.

In order to raise the efficiency of information retrieval, the use of standard formats for the description and automatic formation of index entries is emphasized in designing the structure of the database and processing the data. The layout of access points is comprehensive, reasonable but not tedious, and simple but not omissive. Both the precision ratio and recall ratio are high.

There are 33 fields for each record in the database. These 33 fields are as follows: serial number of temporal records, entries of classification (for typesetting), classification number, numbers for controlling entry, retrieval concept, subject category code, titles, type of document, type of document code, languages, authors, other persons who take responsibilities (such as editors, translators or illustrators), institute in which author works, edition, titles of periodicals, place of publication, name of publisher, year of publication (volume, issue and page), size of books, series notes, standard number of documents, summary, call number, document source code, free terms, descriptors, entry of subject index, Latin name of organism, formula of chemical substance and

registry numbers of Chemical Abstracts, keywords out of context, abstract and so on. Each field has a defined field tag, field name and length, ability of repetition, and separation symbol. Models for each field have been tested and modified again and again and finally have been approved. Experience has proven that all selected fields are suitable. Among the 33 fields, there are thirteen fields for retrieval which are as follows: Classification number, retrieval concept, authors, other persons who are responsible, subject category code, titles of periodicals or book, sponsoring institute, publishing agency, year of publication, free terms, descriptors, Latin names of organisms, keywords out of context, and so on. Now I would like to analyze the access points to the database and its retrieval functions based on the index system.

I. THE AUTHOR INDEX

The data on authors stored in the database consist of personal author, corporate author and other persons who take responsibility including editors, translators and illustrators.

For each record, the maximum number of Chinese authors included is ten and two for foreign authors whose papers have been translated into Chinese. The sequence for name of author is that the surname is put before the given name and all names are sequenced alphabetically.

II. THE SUBJECT INDEX

The subject retrieval is conventional retrieval. But because of a different concept of design, the efficiency of retrieval is not the same. For subject indexing in the database, besides using controlled terms, we also increase the access points and try our best to display the correlations relating to the complete concept. In order to create conditions for nearly consistent retrieval by our microcomputer system, We use @ (commercial at sign) to control the words from the front and make descriptors and free words hierarchical. By so doing, loss retrieval is avoided, access points are increased and descriptors will play an effective role.

Example: English (Chinese)

Pig @ (zhu)	
Berkshire swine (zhu)	Runt pig (zhu)
Fattening pig (zhu)	Sow (zhu)
Lactating sow (zhu)	Two piebald face pig (zhu)
Lean type of swine (zhu)	Weaning piglet (zhu)
Piglet (zhu)	

Land problems are very complicated. They involve politics, economy, law, soil, geology, geography, land reclamation, environment and ecology. A tree structure cannot be formed by using a subject classification for land data. Because their connotation crosses subjects, it is not suitable to design a new retrieval concept. They can not be recalled

by using subjects or subject categories. So using '@' is the only way to control the terms and avoid losses of retrieval.

Example: Land @ (tudi)

Cultivated land	Ownership
Landed estate	Real estate
Land price	Requisitioned land
Land registry	Rural land
Land rent	Urban land
Legacy land	

Reference books contain a subject index to help users. The function of a subject index depends on the indexing technology used and the format of the index entries.

1. Formation of the Index Entries

The index entries of book catalogues are the key in determining the retrieval efficiency of the subject index. In order to insure a high quality of index entries, the efficiency of indexing work must be raised, the formation of entries should be automatic and standard.

We use a special program to control index entries which uses nine function symbols to control the layout of access points and the logical relationship between the descriptors. The nine function symbols are as follows: semicolon ';', exclamation mark '!', question mark '?', equal-sign '=', commercial at sign '@', dash '-', reverse slant '\', right-half bracket '}', asterisk '*' and so on. If a semicolon ';' is put after a descriptor, it means the descriptor before the semicolon must be a guiding word in forming index entries for document records and we simply call it a semicolon descriptor. These guiding words must be the main heading or subheading of the entries. If an exclamation mark, question mark or commercial at sign are put after the descriptors, the descriptors before them can be combined with semicolon descriptors. Exclamation mark descriptors can be put before semicolon descriptors in combination to be main headings and they can also be put after semicolon descriptors to be subheadings. Question mark descriptors can only be put after semicolon descriptors to be subheadings or qualifiers in combination.

Commercial at sign descriptors can only be put before semicolon descriptors to be main headings. Equal-signs and dashes are put before descriptors or qualifiers and they can only be attached to semicolon descriptors, question mark descriptors and exclamation mark descriptors but are not to be rotated. After the entries have been formed the equal-sign descriptors will have been cleared up automatically and they are not stored in the database. A reverse slant is put after the descriptors which means that there is only one word in the entries. When multi-subject documents are handled, the right half bracket is used as a separating symbol to avoid pseudo combinations and conception confusion. When an asterisk is used and combined with '}', it signifies the end of the combination of multi-groups subject.

Example: Study of nutrition of anther cultured plant in hybrid rice

1. translocation and metabolism of phosphorous nutrition in the plant.

After the function symbols have been combined with descriptors, they display as follows:

hybrid rice; anther culture = plant! nutrition-study! rice @) phosphorous =
nutrition element; metabolism = translocation! plant-in vitro?)*

After the index entries have been created, the above example will display as follows in the index entries:

anther culture plant	nutrition study
hybrid rice	hybrid rice
metabolism translocation	phosphorous nutrition element
hybrid rice	metabolism translocation
anther culture plant	plant in vitro
nutrition study	rice
metabolism translocation	hybrid rice
phosphorous nutrition element	

2. Format of Arrangement for Index Entries

The index entries for the database are arranged mainly in line format. The subject headings and subheadings have been formed automatically by the computer system according to the indexing concepts and the notation of function symbols and there is no standard regulation for them. If there is only one subheading or one qualifier, it is put directly to the right of the subject heading leaving a space and putting them in line. If there are more than two second-level headings, the first second-level heading should be put after the subject heading, the other second-level headings are put below the subject heading. The second-level headings, the third-level headings, and the fourth-level headings or qualifiers for each entry should be put in one row leaving a space between the words. By doing so, it is very convenient to retain the real meaning of the descriptors, it is easy to read, a whole page of paper can be saved and the computer can handle it easily.

3. Punctuation Marks, Reading Method and Understanding of Index Entries

In order to easily control them with a computer system, punctuation marks are not used in the index entries and a space is left between subject headings, subheadings, qualifiers, controlled terms, headings in which the words are in normal order and headings in which its words are in reverse order and complicated subjects. Headings in which its words are in reverse order are usually put toward the rear of the descriptors. The format of arrangement for them is as follows:

A. Subject heading: heading in which the first word is in normal order, reading normally.

Example: Agricultural Economy Theory

B. Subject heading plus subheading: heading in which the first word has normal order, reading normally.

Example: Sweet potato germplasm resources
Livestock pathologic anatomy atlas

C. Subject heading plus phrase in reverse order or plus qualifier. When they are read in reverse order it refers to some special names and it is equivalent to "of".

Example: External type of agriculture China

D. Subject heading (or subheading, or heading in which its words are in reverse order) plus control word generally means the subject, the specialty, field, type and place they belong to. It is very necessary to understand them and most of them are read in reverse order.

Example: Agricultural product exchange China
High-frequency curree Method of insect control
Insecticide forestry protection
Insecticide pesticide industry
Insecticide plant protection
Qiminyaoshu China ancient agricultural book
Qiminyaoshu China agricultural history
Yellow stunt of wheat virosis

E. Complicated Subject: for more than two subjects, they should be understand, judged and analyzed.

Example: Resistant ability gene induction laser.

In order to provide more access points and give the words more opportunities to become hierarchical and display more concept relationships, many entry forms are used for the same concept and they are present repeatedly.

Example: White backed rice planthopper
Delphacid planthopper white backed rice planthopper
Egg type chicken
Chicken egg type chicken
Neck blast of rice
Rice blast disease neck blast of rice
Xiada 711
Rice variety Xiada 711

Each entry keeps its original meaning or intention. After entries have been formed they are easy to read and understand. There are thirteen Chinese characters for each entry and the total number of entries is controlled from ten to twenty. The total number, level and indexing depth of index entries for each specialty in the database are kept balanced in suitable proportions.

4. Tail marking

In order to retrieve information precisely and select documents quickly, 22 tail tags are designed after the control number of entries in subject index:

- | | |
|-----------------------------|-------------------------------|
| *A-new status | P-patent |
| *B-new subspecies | *P-hybrid parent |
| B-books | *R-new record |
| *C-new combination | R-review |
| *D-new breed; new cultivars | *S-new species |
| E-community name | *T-new serum type (bacterium) |
| *F-new form | U-cultivar(s) mentioned |
| *G-new genus | *V-variety |
| *H-new subgenus | *W-new strain; Line |
| *K-new section | X-sexual hybrid |
| *N-new name | + -asexual hybrid |

After users have retrieved the useful information through subject index, they can determine at once whether to select the records or give up on them based on the tail tags. If the users need some papers to review, they can find "R" at the end of control number, which means that the documents belong to the review the users want. Otherwise they will not select them.

III. THE SUBJECT CATEGORY INDEX

The subject category index differs from a conceptual index. The former uses codes instead of classification subdivisions and its classification number has been shortened in order to help in computer sorting. It organizes documents by subject category, coordinating the classification number to replace the subdivision. The subject category index can also be combined with the subject index and conceptual index to enhance the retrieval efficiency. For example, it is very difficult to retrieve from the literature by using the classification index, subject index or conceptual index. But if you use the subject category index, it is not only very easy to retrieve what you want, but also to search documents which are very concentrated. If you want to retrieve agricultural information from each district throughout the whole of China by using the classification index or subject index you may consolidate all of China by using only code W10 in the subject category index. If you combine code W10 with code L73 in retrieving, you will get all the literature concerning animal infectious diseases in every district throughout China and it is unnecessary to retrieve them through the name of each place, or kind of disease.

There are 137 valid codes for the database. The subject category codes refer to a subdivision list of systematic classification, but they have better retrieval functionality than that of the subdivision list and are particularly suited to information retrieval in animal science, botany, classification of general agricultural sciences and concerned specialties. The subject category codes and the *Classification of books and serials in China* supplement each other to create new access points. All the codes are flexible and not controlled by the rules of descriptor indexing and are easy to be learned. The codes can replace the function of a subdivision list, but are not controlled by the classification. In document retrieval, the codes can be used not only in combination with a classification number, but also in combination with the subject index. For example, physiology, which has a very close relationship with biochemistry, and also a very close relationship with sciences of plant and animals, outside conditions, agriculture technology, basic sciences and chemical substances, is cross searched with other subjects. If you retrieve them one by one, it is difficult not only to be comprehensive, but also to retrieve them correctly. If you use code F60 plus the name of any plant, or use L50 plus the name of any animal, you will have macro control to form a cross-retrieval series. You may save keying a whole page-long search strategy, help enhance the recall ratio, precision ratio and efficiency, and promote the retrieval process by using the codes.

IV. THE CONCEPTUAL INDEX

Retrieval concept is mainly used in macro-control. It is very difficult to retrieve literature on a specific subject by using the classification index, the subject index or the subject category index. In this case, the conceptual index works well. Let us take biocontrol as an example to describe it.

Most of biocontrol literature is decentralized among the concepts of pest, insect, biology and 'natural enemies' according to the indexing rules. According to the classification rule, the documents involving biocontrol of disease, insects and weed are classified based on control target and there are no specific codes for them in the conceptual index. Because they are often lost in retrieval, the biocontrol concept has been developed. For another example, the documents concerning the application of physical methods in agriculture, are decentralized throughout all aspects of agriculture, forestry, animal husbandry and aquaculture according to the rules of classification. From the angle of the physical method, it is very difficult to completely retrieve the documents concerned with the study method of lasers, ultrasonic waves, optics and electricity and it is common to lose them in retrieval. The shortcomings of other access points can be overcome by designing a retrieval concept for "physical method."

There are 92 terms of retrieval concepts for the database. These terms were determined and selected mainly based on the traditional habits and psychological state of Chinese users, the limitation of agricultural knowledge mastered by computer experts and other staff and the intersection of documents of agricultural sciences with documents of other subjects. All the retrieval terms which are not allowed in the classification index, the subject index or the subject category index are selected and can be combined with the

subject index. A new access point has been created by doing so. For example, a general concept has been designed for "flowering plants" in the systematic classification, only "plant" has been assigned to it in subject category indexing and no specific meaning is emphasized for it in subject indexing. Documents on flowering plants are decentralized under the names of various flowering plants. So it is very difficult to retrieve them. The disadvantages of other access points will be overcome by designing a flower retrieval concept. The access points of the conceptual index can help users save their money for retrieving, enhance indexing depth and are suitable for computer retrieval.

V. CA REGISTRY NUMBER AND MOLECULAR FORMULA INDEX OF CHEMICAL SUBSTANCES

This index is designed mainly for agricultural experts who study chemical substances. Information on application, analysis, characteristics of chemical substances in agriculture, its efficiency of application and development of new chemical substances retrieved only from the documents in the Chinese language is very limited. Therefore it is absolutely necessary to use reference tools and information resources from foreign countries. *Chemical Abstracts (C4)* is one of the most important reference tools for Chinese users. Therefore it is very important for Chinese users to combine the access points of "Chemical substances" with the access points of the database while accessing our database. There are more than ten access points for C4. If the user wants to use the key access point *Index of Chemical Substances* of C4 to retrieve information quickly from a Chinese concept, the only short way is to combine the formula with the registry number of C4. Therefore the C4 registry number has been attached to each Chinese name of a chemical substance in our database.

After you get the standard names of chemical substances from the registry numbers of C4 and the formulas, you may retrieve precisely by using *Index of Chemical Substances*. The method used in compiling the *Index* is that it is sorted not by formula and C4 registry number, but by the names of the chemical substance in Chinese, with the molecular formula and registry number of C4 given at the rear of the Chinese names of the chemical substance. By so doing it may help Chinese users shorten the time span for retrieval. Therefore the formula, C4 registry number and the names of chemicals have been put in the same index and the users can access C4 with the same index and they can save time in retrieving.

VI. THE INDEX OF LATIN NAMES OF ORGANISMS

Organisms are some of the main targets of study in agriculture. A specific field for Latin names of organisms and its index has been designed for the database in order to help users have precise online retrieval.

VII. SOURCE INDEX

The sources of the data will be given periodically. Starting from 1989, a list of reference books or periodicals is given in each issue of the book bibliographies and an Index of Sources will be given each year in order to help users obtain original papers.

VIII. THE INDEX GUIDE

A book catalogue is one of the most important reference tools for getting agricultural documents. In order to reduce the ratio of refusing retrieval an Index Guide is given in each issue of our *Bibliography of Agricultural Sciences in China* and we tell users the relationship of "see references" between important key words and their synonyms. Doing so helps to facilitate the flow of thinking between editors and users, and enhances the recall and precision ratios.

IX. CASES OF RETRIEVAL

The access points to the database are complete, flexible and precise. Retrieval strategies can be written out at once according to the users' questions and the retrieval result is effective. Examples:

User's question:

1. The application of ELISA in quarantine.

Retrieval formula: Enzyme-linked immunosorbent assay *
infections diseases (F60 + L50)

The meaning of the retrieval formula:

- (1) Enzyme-linked immunosorbent assay is a descriptor of ELISA
- (2) infections diseases indicate infectious diseases of plants and animals
- (3) F60 indicates physiology and biochemistry of plants
- (4) L50 indicates physiology and biochemistry of animals
- (5) + shows Boolean logical "union"
- (6) * indicates Boolean logical "multiplication"

Access points: Descriptor is the access point for '(1)'; access point of '(2)' is concept; access points of '(3)' and '(4)' are codes of subject category.

User's question:

2. Dynamics of pesticide application in China and in foreign countries

Retrieval formula: (W\$) * X10

The meaning of the retrieval formula:

- (1) W\$ indicates all places domestic and abroad
- (2) X10 indicates pesticide and all kinds of pesticides

Access points: Access points of '(1)' and '(2)' are codes of subject category. S48 and TQ45 also indicate pesticide and all kinds of pesticides. They only show the pesticides which have been classified based on the rule of classification and they don't include the pesticides which have been classified based on the control target. Their indexing depth and ability of summary are not as good as those of X10. The data on pesticide retrieved by subject are only the general one, not all kinds of pesticides. Therefore X10 has been chosen in this example.

User's question:

3. The relationship between the physiological disease and application of herbicide in wheat crops but not wheat.

Retrieval formula: physiological disease * (herbicide + herbicide) *
(S435.121 ^ wheat)

The meaning of the retrieval formula:

- (1) Physiological disease indicates the physiological disease of animals and plants
- (2) Herbicide is formal descriptor
- (3) Herbicide after "+" indicates the retrieval concept
- (4) S435.121 indicates diseases of wheat crops
- (5) wheat is a formal descriptor
- (6) "*" indicates logical 'multiplication,' multiplication of concept
- (7) "+" indicates logical 'union,' union of concept
- (8) "^" indicates logical 'negation,' negation of concept

Access points: Access points of '(1)' and '(3)' are concepts. Access points of '(2)' and '(5)' are descriptors, being the subject retrieval. The subject in '(2)' is herbicide and herbicides in general which does not include all kinds of herbicides. Access point '(4)' is classification. S435.121 is the mark of classification and indicates disease of wheat crops. The examples of retrieval mentioned above show that when subject categories and retrieval concepts are combined with descriptors and marks of classification, the retrieval is simple and precise. Boolean retrieval and front consistent retrieval can be realized and rear consistent retrieval can also be realized on our HP3000/70 computer system.

The retrieval practice of eighty users in retrieving 30,000 records has proved that the inverted files of the database are effective and precise. The formation of entries controlled by the computer's functional symbols is logical, easy to read and understand and can keep the original meaning of words. All entries and indexes are typeset and printed out by Kehai software to meet the design requirements.

Thirteen retrieval fields, eight indexes and 22 tail marks can be combined with each other in retrieving and it is an effective information retrieval system such that once "the headrope of a fishing net is pulled up, all its meshes open."

Management of the AGRIS and CARIS Regional Centers in Southeast Asia

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Abstract

Experience gained from a decade and a half of information networking in the Southeast Asian region is analyzed, with a view to forwarding insights that would be useful in the study and evaluation of similar systems existing in other Third World environments. Emphasis is on the AGRIS and CARIS systems of the FAO and their role in the development of national agricultural information systems in the region. The changing character of the coordinating function of AIBA is discussed in the light of member countries' maturing national information systems.

Introduction

It is indeed a pleasure for us at the Agricultural Information Bank for Asia (AIBA) to be invited to participate in this symposium to share with you our sixteen years of networking experience in the Southeast Asian region. To be sure, there were, and are, numerous problems attendant to networking efforts of this kind, but I can say with all sincerity that its long-term benefits (both at the national and regional levels) far outweigh the problems encountered. Moreover, the task of networking is both challenging and very satisfying in terms of making a contribution to national and regional development efforts.

I propose to develop the topic assigned to me in the following manner: the first part will provide a brief background on AIBA, which hosts the AGRIS and CARIS programs in Southeast Asia. The second part will discuss the gains made in the region as a result of these networking efforts, while the third part will analyze the shortcomings in the implementation of its planned programs. The last part will delve into some current issues with which we are grappling in our attempt to be as responsive as possible to our users' needs and to our changing role as a regional information center.

A. Background on AIBA as the Coordinating Center for AGRIS and CARIS in Southeast Asia

AIBA is a regional information system established by the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) in 1974 in response to the need in the region for more effective information services in agriculture and related fields such as forestry, fisheries, and rural development. As an agricultural information system, AIBA is the designated regional coordinating center for two of the United Nations Food and Agriculture Organization's (FAO) information services

namely the International Information System for the Agricultural Sciences and Technology or AGRIS and the Current Agricultural Research Information System or CARIS.

Initially composed of nine countries, namely Indonesia, Malaysia, the Philippines, Singapore, Thailand, Bangladesh, Korea, Sri Lanka and Hong Kong, it has since reduced its membership to the five Southeast Asian countries of Indonesia, Malaysia, the Philippines, Singapore and Thailand. This was for reasons of better manageability of the system.

In each of the member countries, there are government-designated AGRIS and CARIS centers that are responsible for the bibliographic control of their current agricultural literature and research projects. Data on these are regularly sent to AIBA where they are processed and merged into regional files called AGRIASIA and CARIS-SEA. In the case of AGRIS, the merged data are forwarded to the AGRIS Processing Unit in Vienna, Austria where they are further merged with other agricultural literature from all over the world.

1. Objectives and Functions

Now in its sixteenth year of existence, AIBA has evolved into a major agricultural information service with the following objectives:

- To serve the information needs of Asian countries in the field of agriculture and allied disciplines.
- To promote new and improved techniques for handling and disseminating agricultural information.
- To serve as the coordinating center in Southeast Asia and other Asian countries for the two international agricultural information systems of the Food and Agriculture Organization (FAO), namely: International Information System for the Agricultural Sciences and Technology (AGRIS) and Current Agricultural Research Information System (CARIS).
- To serve as an international information and referral center on given agricultural commodities and subject areas.

Its functions are:

- To select regional scientific agricultural information useful to users.
- To analyze and process this information using advances made in information technology.
- To provide access to this information by users.
- To provide training in scientific information work.

2. Regular Outputs of the Information Service

At present, AIBA regularly produces, updates and maintains the following outputs:

- a bibliographic database called *AGRIASIA* composed of almost 84,000 records of Southeast Asian scientific agricultural literature covering the period from 1977 to the present, as well as a printed quarterly version.
- a database on on-going agricultural research in the region called *CARIS-SEA*, as well as an annual printed version in the form of an inventory.
- an integrated database (i.e., bibliographic as well as a non-bibliographic, referral-type database) on medicinal and aromatic plants called *APINMAP* (Asian Pacific Information Network for Medicinal and Aromatic Plants) sponsored by UNESCO.

3. Information Services Offered

Like other information services in the developing countries, AIBA started out in 1974 largely on a manual basis. That is to say that our services, most notably our bibliographic services, were produced manually. The *AGRIS* input sheets were prepared and typed onto OCR (Optical Character Recognition) sheets at the regional center at SEARCA (and eventually at the National Centers themselves) before being sent on to the *AGRIS* Processing Unit in Vienna, Austria for inclusion in the worldwide bibliography on agriculture called *AGRINDEX*. The first two issues of the regional agricultural bibliography, *AGRIASIA*, were produced manually in 1976, with considerable time and effort invested by the AIBA staff in its production.

By 1977, the AIBA gained access to a computer by sharing in the use of an IBM 370/135 mainframe of the Agricultural Resource Center (ARC) located on the campus of the University of the Philippines at Los Banos, SEARCA's host institution. This alternative, while solving some of the information processing problems of AIBA, was not totally satisfactory, as our access was severely limited (due in part to hardware limitations and in part to user pressures on the system).

Early on, it became obvious that for the AIBA system to develop along the lines planned for it, it had to have its own computer. The project was finally able to acquire its own computer with the help of the International Development Research Centre (IDRC) of Canada in October 1982.

The arrival of the computer eased our problems to a great extent, and enabled us to offer a whole new range of services that we were formerly unable to give. This is possible due to the fact that the computer allows us limitless interactive usage which was not possible with the ARC computer.

The computer system acquired by AIBA is a Hewlett-Packard 3000 Series 40 minicomputer with the following configuration: 1MB main memory, 11 terminals, one 1600 bpi magnetic tape drive, one 600 lpm line printer, and two disc drives (one 120MB and one 404MB). The system operates under the Multiprogramming Executive (MPE) software.

For storage and retrieval, AIBA uses software called MINISIS, which was donated by the IDRC. MINISIS is an information management system developed by the IDRC which is designed to run only on the HP3000 family of computers. It allows the definition and creation of databases without resorting to any computer programming, most of the work being done in an interactive mode.

In addition, each of the member countries in the AIBA system now have their own IBM (or compatible) PCs, which enable them to send their input to AIBA in floppy disks. The regional center processes such input through an IBM PC linked to the HP minicomputer through an emulator. Exchange of information within the system is now effected through diskettes, having done away with input sheets since 1985.

Thus, our services at the present time include, aside from our bibliographic services like AGRISIA, online literature searching, inquiry-answering, referrals, document delivery in the form of microfiche or hard copy, and the provision of training in information handling, using mainly computerized methods.

With the acquisition of the minicomputer, all of our bibliographic outputs are now computer-generated. These are composed of our major outputs, AGRISIA and CARIS-SEA, and of our Asian Bibliography series and our occasional special bibliographies on topics where there is perceived interest, the latest one being on integrated pest management published in 1988.

Online literature searching for users upon request may take the form of retrospective searching or be simply limited to current literature searching, in which case it could either be a one-time search or a recurring one called Selective Dissemination of Information or SDI. We use our in-house databases as well as the AGRIS database in Vienna, Austria, which covers the world's agricultural literature. We access the AGRIS database via TYMNET using a telecommunications facility in Manila, the capital of the Philippines.

We also act as a referral center for inquiries which we cannot serve or for which we cannot provide copies of documents. Users are either referred to our national centers or to other information centers which would have copies of needed documents or be in a better position to handle given requests. In conjunction with this, our inquiry-answering service handles requests for information which come from all over the world. Document back-up comes in the form of either photocopies or microfiche.

Finally, I should mention one last important service, which is that of training. The AIBA regional center as well as its national centers are actively involved in providing training in various aspects of information handling. Short-term training programs are regularly set up in such areas as indexing and abstracting, micrographics, computerized information storage and retrieval (e.g., use of Mini-Micro CDS/ISIS) and other related aspects of information work.

B. Benefits and Accomplishments

1. Benefits Derived from the Regional Network

Before going into a discussion of the gains made by the network, it would be well to touch briefly on the benefits participants get from networking. The two most important benefits to be derived by a country in joining an information network (be it regional or international) are: (1) Access to literature of other member countries which would otherwise be difficult to learn about, much less obtain (in brief, resource-sharing and its concomitant advantages); and (2) Strengthening of national information systems.

Resource-sharing

During the first few years of AIBA, some of its member countries were openly skeptical about the advantages they would derive from joining the network. Why join a regional network when they could just as well input their literature directly to AGRIS and get the same benefits anyway?

It was eventually realized by these countries that aside from the fact that a regional system, being smaller, would be more responsive to their needs, they also get good value for their contribution in terms of training and outputs that they regularly receive. Add to this the provision of a platform for the discussion of common problems, and a clear picture emerges of advantages derived versus disadvantages. The network has been able to launch and sustain many projects over the years because of the strong spirit of cooperation which has always prevailed among the member countries.

Strengthening of National Information Systems

Perhaps the most important advantage to be derived from membership in an information network is the help received in the development and subsequent strengthening of national information systems. Membership in the regional network has led to the establishment of a mechanism for better control by each country of its agricultural literature, which would have been much more difficult to accomplish if each country had been acting alone. The computer-produced national agricultural bibliography series of AIBA is evidence of the ease with which a regional network can help national centers in accomplishing bibliographical control of their literature.

Valuable training in scientific documentation work, as in mechanized information storage and retrieval techniques which are afforded the staff of national centers, is another AIBA-sponsored activity that translates positively to the development of national information systems. After sixteen years of existence, what gains have the regional networking efforts for AGRIS and CARIS made? From the time AIBA was established, the following may be cited as its more important accomplishments:

It has introduced and made operational the concept of an agricultural information network initially involving nine countries in Southeast Asia and subsequently, five

Southeast Asian countries (i.e., Malaysia, Singapore, Thailand, the Philippines and Indonesia).

It has been able not only to establish itself but also successfully function as the Asian regional coordinating center for two of the FAO's global information projects, AGRIS and CARIS.

It has been able to service the information needs of its users (e.g., scientists, researchers, and extension workers) in the region and elsewhere through its regular bibliographic publications such as *AGRIASIA*, a national agricultural bibliography series (produced by the participating countries themselves) and annual inventory of ongoing research called *CARIS-SEA*, as well as other related information services.

It has helped develop the national agricultural information infrastructure of each participating country in the network.

It has helped train appropriate staff members of its national documentation centers and other interested institutions in Asia in advanced documentation and information work.

It has developed computerized bibliographic databases on agriculture and other related fields for users.

It has been providing a wide array of information services, ranging from online literature searching to provision of needed copies of documents.

It continues to act as the coordinator of the activities of two information networks, the Agricultural Information Network - Southeast Asia (AGINFONET-SEA) and the Asian Pacific Information Network for Medicinal and Aromatic Plants (APINMAP).

C. Shortcomings and Lessons Learned

It is easy enough to become complacent about the adequacy of information services that one provides, so that instruments for the evaluation of services must be regularly used to ensure that a system remains effective and relevant.

The first evaluation study on AIBA was the one commissioned by the FAO in 1985. It was a regional case study on the problem of access to documents in the Southeast Asian region (AIBA, 1986). A stratified sample of one hundred users (i.e., scientists, researchers, professors, graduate students, agro-businessmen, administrators, etc.) was chosen from each of the following countries: Indonesia, Malaysia, the Philippines, Thailand, Bangladesh, and the Republic of Korea.

Out of the 600 respondents, an 87% rate of return was realized. The single, most important finding from that study was the fact that users' information needs were not

being adequately met by AIBA. The major problems identified may be summarized as follows:

1. Users' needs were not being met by the AIBA information services because the format of the information provided was often not suitable to meet such needs.
2. Inefficient document delivery system: the time lag between the request and eventual receipt of copies of required documents was too lengthy.
3. Information content: abstracts of literature citations provided were not always available; translations from foreign languages were not provided.

The second evaluation study on AIBA was undertaken upon the suggestion of the new SEARCA director who assumed office in late 1985. A proposal to this effect was submitted to possible funding agencies, to which the IDRC responded positively. Dr. Jacques Valls of the Asian Institute of Technology in Bangkok, Thailand was commissioned by the IDRC to undertake the evaluation study, which took place from April to May, 1986.

The overall finding of the study was that while AIBA was able to meet some of its objectives, it failed miserably in others, like responding adequately to the changing needs of its national centers and users. Because of the need to decide on the fate of the information system, a meeting of the AIBA Consultative Committee (composed of the heads of the national centers and the AIBA project manager) was set for October, 1986.

As a result of the 7th AIBA Consultative Committee Meeting held in Serdang, Malaysia from October 6 to 10, 1986, a restructuring of the network was effected to make it more responsive. The restructured network would now be called the Agricultural Information Network for Southeast Asia (AGINFONET-SEA), which would be composed of AIBA (as the coordinator) and the national nodes in the five member countries.

The implications of this are two-fold: first, it shows the degree of maturity already reached by the national information systems; and second, it would now free AIBA to develop new information products and services in its new role as coordinator of the network.

In agreeing on the continuation of AIBA, the Consultative Committee recommended that it:

- continue to be instrumental in fostering the spirit of cooperation among the member countries; continue to work closely with AGINFONET-SEA;
- continue to be the regional coordinating center for the network;
- vigorously pursue its role as a training center for agricultural information for the region; and

- continue to be the catalyst in the adoption of new information technologies for the benefit of users in the region.

These recommendations helped shape the direction of AIBA for the next five years, and are echoed by an evaluation study of the CARIS program conducted early in 1989 (Anuar, 1989).

Valuable information was gleaned from these evaluation studies as well as from continuing feedback from users, which may be summarized under the following points:

1. Importance of maintaining good communications within the network. Cooperative schemes like the AIBA set-up must ensure good and constant communication with its participating countries to keep it viable. Since the last AIBA Consultative Meeting in 1986 and the Regional IAALD conference in 1988, there has been no face-to-face contact with the members of the network, with the result that interest in the network's activities, like maintaining input into the two regional databases, has tapered off. True enough; the network has to compete with other current interests of its participants such that a high level of interest must be cultivated and sustained among members. Newsletters and letters are important, but interaction in meetings is invaluable.

2. Involving members in planning exercises for the network. As is true in other activities, the likelihood that an activity of the network will succeed depends on the extent to which the members are involved in its conception, design and implementation.

3. Need for a continuous training program. At every stage of a network's development, training of one kind or another is needed, especially in the technical aspects of cooperative output production. While there is universal agreement on the need for such, problems of funding and lack of in-house expertise to give training constantly arise. Where external funding and expertise are made available (in our case, from funding agencies like IDRC, UNESCO, or even FAO), then well and good; where these are not found, then alternative strategies as to who shoulders what costs must be threshed out and agreed upon by the network members. It is well to try to provide adequately for this recurring cost of human resource development in any planning exercise of a network. After all, properly trained "people-ware" are its most important resource.

4. Need for a technical group. Aside from a policy-making body, a network would be wise to have a separate group to take care of the technical contents of the outputs of the network. This is being practiced by AIBA in the case of APINMAP, with excellent results.

5. Services must be need-based. In the early years, AIBA tended to be rather prescriptive in the kind and format of services it offered to users. Today, we strive to be in constant dialogue with our users, as we are aware that their needs change.

6. Outputs must be tied with marketing strategies that work. A product may be technically good, but will not be that much used because few are aware of its existence. We have found that advertising helps. Marketing of information products, though, must not be a sporadic activity but a sustained and on-going program of an information unit.

D. Current issues

Today, AIBA and to a larger extent, AGINFONET-SEA, are coming to grips with current concerns that affect their effectiveness. Three such issues will be briefly discussed, i.e., non-use of information services offered; impact of new technologies, specifically laser optical disk technologies; and development of non-bibliographic databases.

1. Non-use of information services offered.

For the past two years, AIBA has been conducting a research study on the extent of use made of AGRIASIA among faculty and staff members of the University of the Philippines at Los Banos. From a random and stratified sample surveyed last year, we found a) that users found the database not comprehensive enough in its coverage, and b) that relevant documents found in their literature searches were not readily available.

We subsequently tested the first reason by selecting one of the institutes on campus and systematically comparing the published and unpublished output of its senior staff members for the past two years with those we have in the database. We found, to our dismay, that indeed, only a small percentage of output by staff members ever gets included in the database. So we are currently undertaking a project for the enhancement of AGRIASIA.

The non-use of information services is a complex problem which needs to be carefully researched by all of us.

2. Impact of new technologies.

Next to computers, the most talked about technology in the profession, at present is the CD-ROM. Most of the big bibliographic databases already have versions in this medium. In the field of agriculture, the Commonwealth Agricultural Bureaux International (CABI), the National Agricultural Library of the United States, and AGRIS, have already placed all or part of their databases on CD-ROM.

This is an excellent medium for providing information to users, but we still need to market and educate them properly about this new technology. To illustrate, the International Rice Research Institute, together with AIBA, were recently designated as test sites for a full-text CD-ROM project of the Consultative Group for International Agricultural Research (CGIAR). Both of us subsequently discovered that we could not read the disk because the CD-ROM Extensions software on our existing CD-ROM readers was an older version that would not read the required High Sierra format. The irony was that IRRI went to the trouble of purchasing a new reader and a dedicated microcomputer to enable its users to test the new technology. However, hardly any

interest has been elicited from users to go for demonstrations, much less use, the technology!

3. Development of factual databanks.

In our contacts with users, especially with those outside of academe like agro-businessmen and corporate planners, the feedback we most often get is their need for non-bibliographic, factual-type information to help them better meet the demands of their jobs. It is in response to this that we have started to think of extracting technology-based information from AGRISIA and developing a separate factual database with technology as the unit of analysis. In our APINMAP project, we are moving fast toward the development of a factual databank on five of the most common ailments in the region. This constitutes one of our major activities for the next two years, with UNESCO sponsorship.

E. Conclusion

This paper presented various facets of the complex mix of activities that go into the management of the AGRIS and CARIS programs for Southeast Asia. Some measure of success has been achieved, but much more needs to be done. And, as we near the end of our second decade of existence, we hope to remain a relevant force in agricultural information dissemination in Southeast Asia and elsewhere.

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Preliminary Study on the Microcomputer-aided System for Compiling an Agricultural Thesaurus and the Establishment of a Descriptor Database Management System

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Abstract

Some theoretical and practical results of a study on the Computer-Aided System for Compiling an Agricultural Thesaurus (CASCAT) and the establishment of the Descriptor Database Management System (DDMS) are presented. The CASCAT is designed in accordance with international and national standards to meet practical needs, by adopting a natural classification structure of descriptors. The entries in the thesaurus are chosen, compiled and recorded by their positive relationships while compiling based on negative relationships is controlled by programming. The DDMS is composed of several subsystems and has the function of compiling the thesaurus, maintenance, inquiry and searching, and outputting. The structure and outputting procedures of the DDMS are described.

We have conducted our research work on the subject of the Computer-Aided System for Compiling an Agricultural Thesaurus (CASCAT) and the Descriptor Database Management System (DDMS) since 1986 and have achieved some preliminary results.

The following are our views on some issues concerned.

I. On Compiling a Thesaurus by Computer

Using a computer to compile a thesaurus should maximize the advantages of the equipment and technology, and minimize the amount of manual labor so as to reduce errors and increase efficiency.

Therefore we set as objectives to develop a system that could:

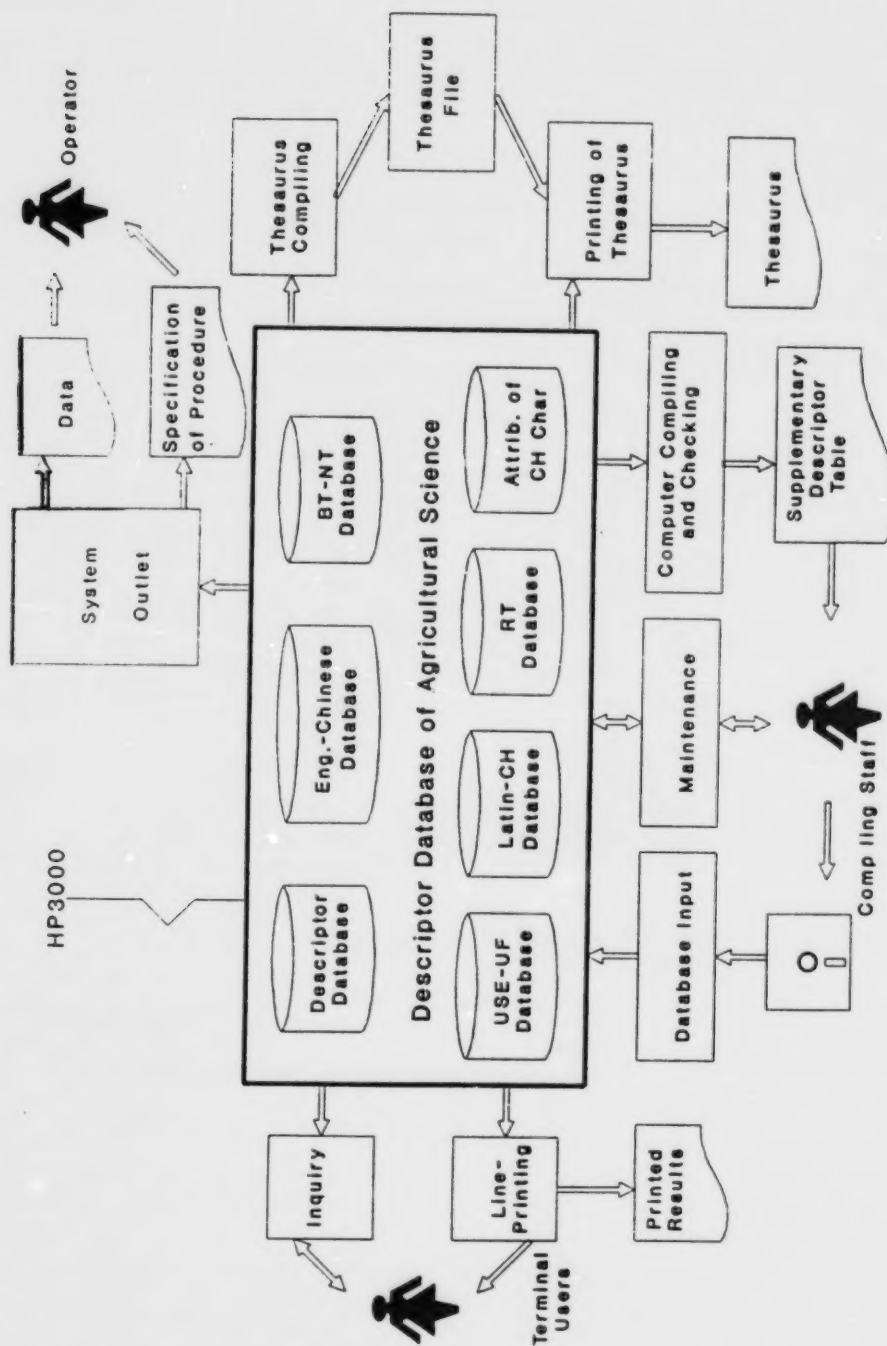


ILLUSTRATION OF THE STRUCTURE OF MICROCOMPUTER-AIDED SYSTEM FOR COMPILING AGRICULTURAL THESAURUS AND DESCRIPTOR DATABASE MANAGING SYSTEM

- compile the thesaurus with assistance from experts in various fields and specialties;
- support the publication of the thesaurus in different formats;
- support dynamic management of the thesaurus;
- provide convenient inquiries to the database;
- free the thesaurus staff from massive manual labor.

Up to now the interface provided to compilers by most descriptor database systems is a separate structure of descriptors, i.e., the unit used for compiling is separated individual descriptors, which are separately labeled with USE, UF, BT, NT, and RT, etc., for their relationships. So the most distinct short-comings of this method are the massive labor requirements and the ease of making errors.

On the other hand, the interface provided by our system is a natural classified structure, i.e., the structure is described by classified specialties, classified descriptors and BT-NT relationships displayed in an indented hierarchy. Only the one-way RT relation is described in all used-for and relative relationships. This interface avoids forced separation and limitations of descriptors, but provides a familiar access for the compilers. At the same time, it also provides the maximum amount of information with a minimum number of items involved.

Another very effective function of the DDMS is to check the rationality, unity and completeness of the thesaurus, furthermore, it may correct the compilers if they violate the standards of ISO and *GEDCT (Guidelines for Establishment and Development of Chinese Thesauri)* (proposed).

It is superior to other computer compiled thesauri and guarantees the quality of the thesaurus.

II. Scheme for Compiling and Recording of Descriptors

The usual method to set up a descriptor database is to take each descriptor and its indicated reference system as a unit, and input every descriptor with its respective relationships. Then, after sequencing, an alphabetic descriptor database is formed. The alphabetic thesaurus is then produced by outputting according to certain formats and printing. The great advantage of the above-mentioned method is it is simple to program and economical, but it occupies extra storage with its large amount of data and costs time and labor in maintenance.

Since the thesaurus of agricultural science and technology covers forty subjects, 200 specialties and over 60,000 descriptors, we have to choose a new method different from the traditional ones, i.e., to input descriptors only by the positive relationship of the descriptor while their necessary reverse relationships are controlled by programming, which can be formulated automatically when necessary.

The advantages of this method are as follows:

1. To reduce the amount of computer memory as well as the work load of input;
2. To provide convenience and flexibility in database maintenance. Once a descriptor and its relationships are changed, other related descriptors and their relations will be automatically corrected;
3. To take the classified thesaurus as source data so it can formulate not only the reverse relationships, but can also derive an alphabetic thesaurus and thesauri at the 2nd, and 3rd level or on a specific discipline to meet various demands.

By this method, about half of the inputs in inputting the RT relations and about two thirds in inputting the BT-NT relations are reduced. Since the maximum number of levels of descriptors in the agricultural descriptor database is seven, the maximum input can only be seven entries or times, while by traditional methods, it was nineteen entries or times. Therefore, the efficiency is at least doubled.

III. Structure and Function of DDMS

1. Structure of the system

The system consists of six subsystems:

- (1) Subsystem for data input and transfer, and construction of the database;
- (2) Subsystem of computer-aided compiling of thesaurus;
- (3) Subsystem for output of descriptor database;
- (4) Subsystem for maintenance of database;
- (5) Subsystem for users of the database;
- (6) Subsystem of development on the database.

2. DDMS

In order to perfect the system, we have improved the design to achieve the following functions on the whole:

- (1) Functions of thesaurus compiling system, including:
 - a. input and transfer of descriptor data, and database construction;
 - b. check on the logic of descriptor data and their reference system;
 - c. creation of descriptors' rotated term index;

d. compiling and printing the alphabetic thesaurus, classified thesaurus, multilingual thesaurus and indexes in various formats.

(2) Function of maintaining 3-grade classification system and relations among descriptors.

(3) Functions of maintenance on the system, including functions of security, maintenance on database copying and restoration, removal of usage frequency and correction of unit, development and outlet for connection to the HP3000.

(4) Function of inquiry by users (indexing users and retrieval users). The validity of a database system often relies on the convenience, efficiency and accuracy of the inquiry function. By applying the easy-to-use menu-driven design, our system provides up to fourteen primary inquiry functions on the basis of the effective database system and its inquiry subsystem.

(5) Output function of the database. The compiling and outputting subsystem of the thesaurus has the following features:

a. Multiprocessing demand: it is able to compile and output various types of thesauri;

b. Multilingual ability: It can produce the thesaurus in Chinese, English, Latin and bilingual editions and indexes of English-Chinese, Chinese-English, Latin-Chinese, and Chinese-Latin;

c. Multiformats: It can provide various display formats;

d. Multiple orders of Chinese characters: the Chinese language descriptors can be arranged in various orders, e.g., in the order of Pinyin (phonetic letters), and in the order of strokes, etc. It has solved problems with duplication of orders and codes;

e. Multiple-phases: the thesaurus is divided into a number of sub-thesauri for compiling;

f. Multiple table index: to each entry in the classified thesaurus, information is provided on the alphabetic indexing of the entry in the thesaurus.

IV. On the Structure of the Agricultural Descriptor Database

In setting up the agricultural descriptor database system, it is important not only to create a database storing all descriptors, but also to establish various relationships among descriptors.

1. Establishing the database entities and their relationship model (E-R Model).

According to the usual method for setting up databases, we define first of all three entities for a database, i.e., classified items, descriptors, and origins of words; then the relations among the three entities are established, mainly classification relationships, word family pedigree relationships, use-for relationships, relative relationships, and word origin relationships.

2. Definition of entity attributions and relation entity attributions.

These include:

- classified item attribution (L)
- descriptor attribution (K)
- word origin attribution (O)
- classification relation (R1)
- classifying relation of word family (R2)
- BT-NT relation (R3)
- USE-USE FOR relation (R4)
- relative relation (R5)
- compatible relation of terms (R6)

3. Descriptor database model and the database.

Our agricultural descriptor database is established on the basis of the relational database model, while the management system consists of the above-mentioned nine relations, i.e., L, K, O and R1 to R6. It has been approved that the relational database system consisting of nine relations conforms to the definition of 3NF from E.F. Codd.

4. Chinese character attribution bank.

In order to solve the problems of sorting Chinese characters from multiple keys and the same value of keys in sequence, we have created the following character attribution relation table in the database system: Chinese code, Pinyin sequence code, stroke code, Pinyin stroke. Within the database, Pinyin, Pinyin address code, stroke and stroke order code are automatically formed.

V. Outlet of DDMS for users

The main feature of the DDMS's outlet for users is menu-driven supplemented with a small number of commands. It provides flexibility as well as convenience to operators who are not familiar with computers. Managing by authorized users is another feature of the outlet. Only those users who know the right sequence codes can use the system.

At the same time those users who know the right sequence codes are divided into three levels. The range of functions in the system for users at each level is restricted to ensure the security of the database system.

The above are some preliminary results we have achieved in our study on CASCAT and DDMS. Suggestions and criticism are welcome from all specialists and colleagues.

Digitized Image Transmission Using High Speed Telecommunications Networks

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BACKGROUND

The National Agricultural Library (NAL) and 44 major universities in the United States have been working for the past two years on a cooperative project to test a new method of capturing full-text and images in digital form for publication on CD-ROM (Compact Disc-Read Only Memory).

Phase one involved testing the scanning/optical character recognition (OCR) workstation and evaluating several commercial software retrieval packages, as well as eliciting reactions from both university librarians and end users.

The first CD-ROM contains 4,000 pages of aquaculture material, and uses Textware software. The second disc contains documents published by the Consultative Group for International Agricultural Research (CGIAR), using KAware2 software. NAL's extensive collection on the herbicide Agent Orange provided the documents included on the third disc, which uses Personal Librarian software for access.

Each CD-ROM includes both bit-mapped page images and corresponding ASCII files which allow for full-text retrieval.

Phase two is being accomplished under a grant from the U.S. Department of Education at the University of Vermont where approximately 1,000 Canadian government documents pertaining to Acid Rain are being scanned, digitized, and cataloged. The resulting 11,000 pages will be published on three CD-ROMs and distributed to the participating land grant libraries in March 1990.

IMAGE TRANSMISSION OVERVIEW

Phase three, the transmission of digitized page images to remote sites is being conducted by NAL and the North Carolina State University (NCSU) Libraries will evaluate the following elements:

- 1.The use of standard, widely-supported image formats for scanned page images
- 2.The use of widely available computers for display and manipulation of the page images

3. The efficiency, speed, and ease-of-use of the national Internet and local area networks for distributing page images

4. The administrative arrangements and structures required for soliciting requests and satisfying them through electronic distribution.

Image Format

The project will be using Tagged Image File Format (TIFF) as the data exchange standard for digitized page images. The scanning workstation at NAL currently creates image files in a special high resolution LaserView format which must then be converted to TIFF by software algorithms.

End User Computers

In order to display the LaserView page images, users in the first two phases of the project must have a special high-resolution monitor. This third phase will investigate techniques that will enable a user to obtain the best possible image on whatever retrieval station is being used. Most of the nodes used initially at NCSU will be Macintosh IIs.

Internet and Local Area Networks (LANs)

The U.S. National Science Foundation's Internet currently connects more than 40 of the universities which closely cooperate with NAL, although not all of their libraries are connected, yet. NCSU will utilize the Ethernet capabilities in its computer center and the AppleTalk-based LAN in the D.H. Hill Library to retrieve image files from Internet and redistribute them to users.

Administrative Procedures

Project staff at NCSU and NAL will develop and evaluate several mechanisms for processing document requests, both for this limited study and also should image transmission be adopted for inter-library lending (ILL) production in the future.

IMAGE DELIVERY TO END USER

After the page images are received and acknowledged by NCSU Library staff, they must be distributed to the requestor. Three distribution methods will be evaluated.

1. Direct electronic delivery: The requestor will pick up an electronic copy of the images directly from the NCSU VAX computer, once notified by Library staff of the file location.

2. Intermediate electronic delivery: Requestor will review images on one of the NCSU Library nodes. If electronic format is required, Library staff will provide copy of images on diskette.

3. Print copy delivery: NCSU Library staff will review images and print copy at 300 dpi for delivery to requestor.

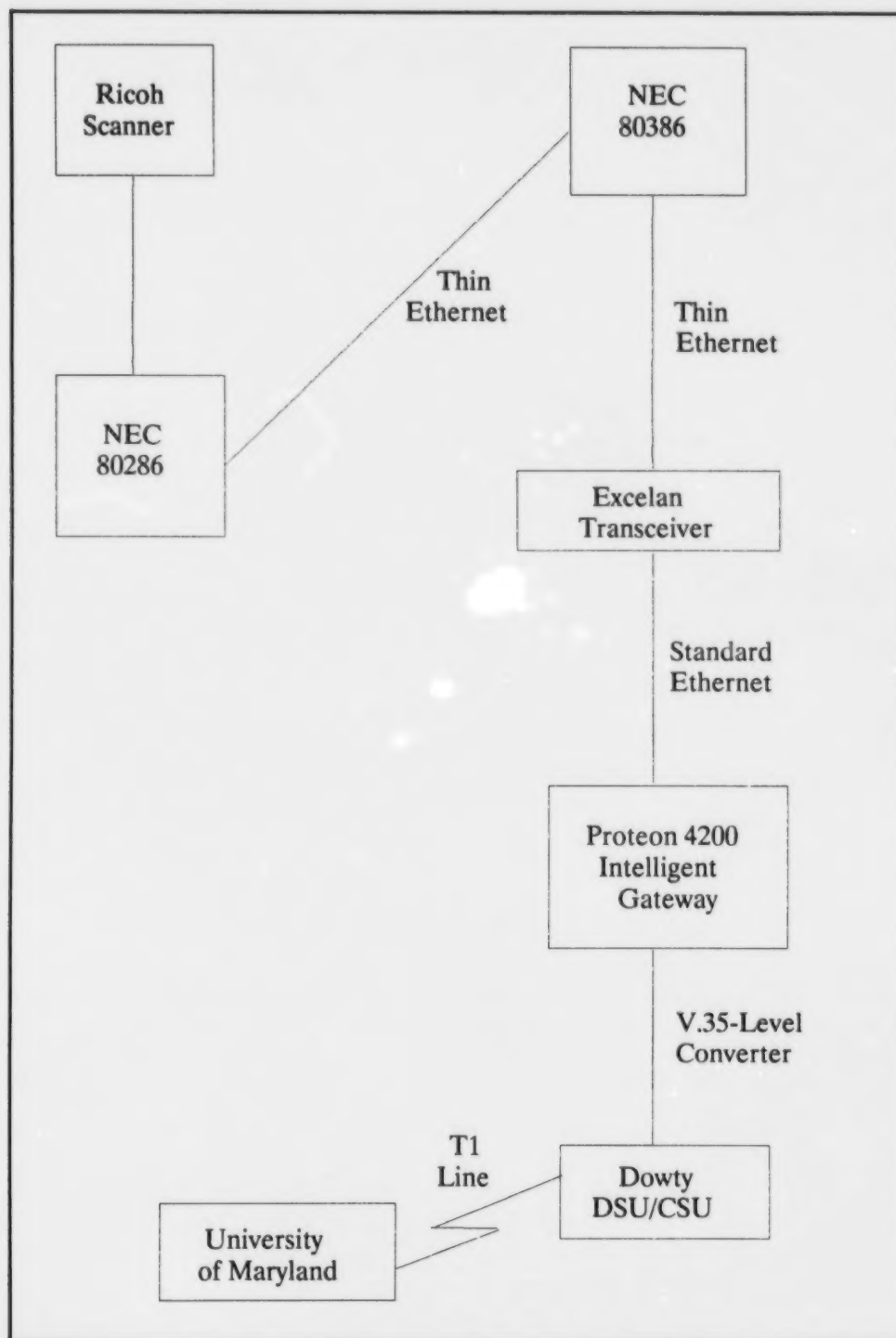


Figure 1. Equipment Installed at NAL

OPERATING ENVIRONMENT

NAL has installed several pieces of equipment to enable us to access SURAnet, one of the thirteen regional Internet Protocol networks. (Figure 1) Because NCSU is already connected to SURAnet, and has an operating AppleTalk local area network, they only needed to connect the D.H. Hill Library with the Computing Center.

For this pilot project, NCSU Library staff will utilize several mechanisms for locating and processing document requests that can be satisfied by the project technology. (Figure 2)

Sources of Citations

To insure that requested documents are located at NAL, three sources will be preferred:

1. Aquaculture CD-ROM

[NAL will have digitized images already]

2. AGRICOLA online or CD-ROM

[or *Bibliography of Agriculture*]

3. OCLC records with NAL as a location

Sources for Requests

Most requests will originate at the D.H. Hill Library, or be channeled through there at least initially. The agricultural research area, the Veterinary Medicine Library, and other locations may also generate requests.

Because of copyright concerns, only documents produced by the federal government or other copyright-free publications will be requested/delivered. While there are certainly enough such publications to satisfy this pilot project, the copyright issue has to be addressed before any large-scale implementation of an image transmission system could be considered.

Delivery of Requests

Requests will be sent to NAL by Email via Internet, Bitnet, ALAnet, etc. The project will also investigate using the OCLC ILL system and telefacsimile to request documents.

Filling of Requests at NAL

NAL Lending staff will divide the requests into "Special Handling" and "Normal Workflow," to assess impact on Lending and contractor workflow. Special Handling requests will be sent by FAX and received throughout the day. Normal Workflow requests will be sent by Email and received by NAL once each day.

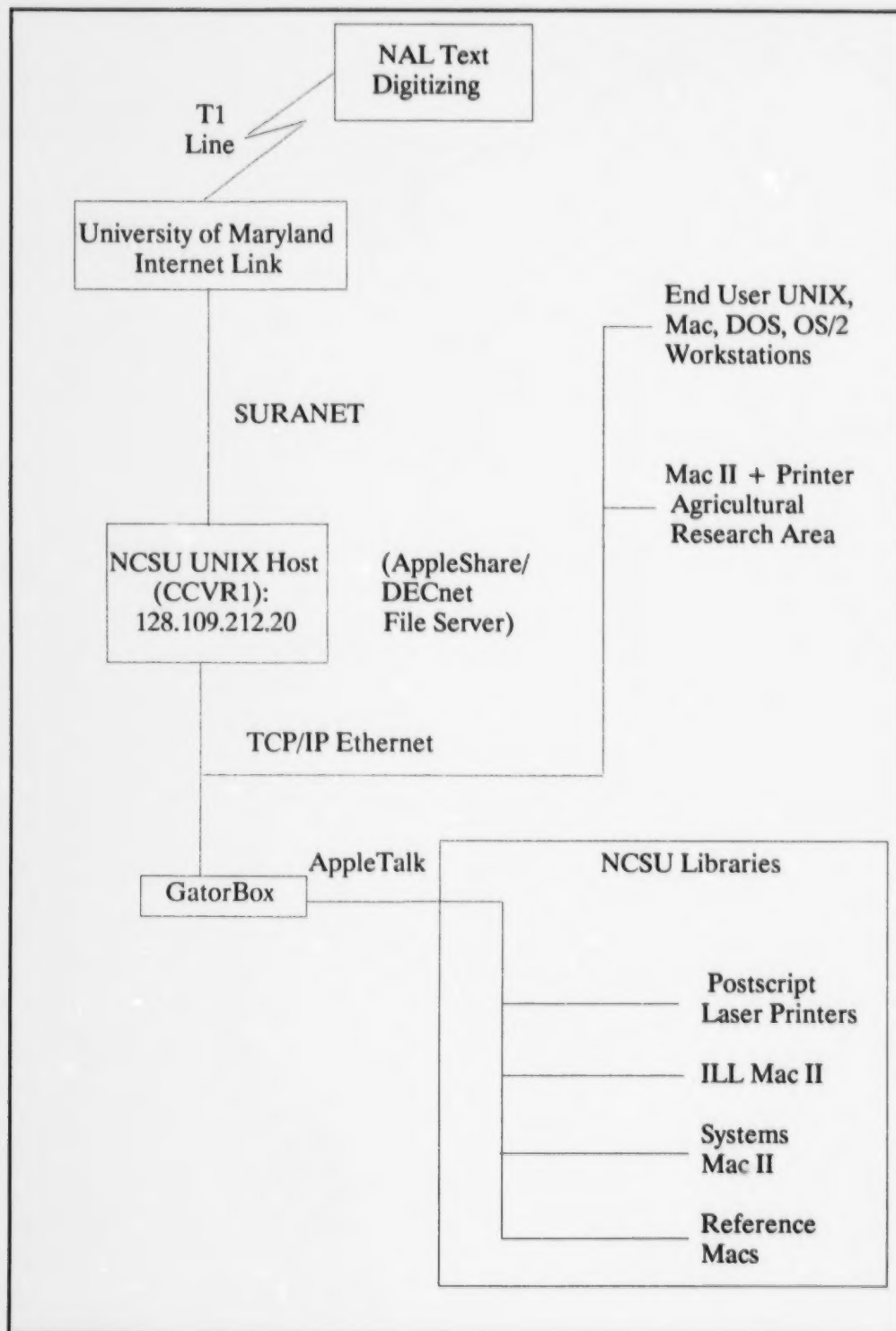


Figure 2. Network Schematic.

EVALUATION

The evaluation will address four broad areas: ease of use and accessibility to the end user, demand, cost-effectiveness, and copyright issues. If the system proves to be "user-friendly," and/or the demand is sufficient, and/or this means of document delivery is cost-competitive, and/or copyright issues can be resolved, then further progress along the lines of this project would clearly be warranted.

FUTURE DIRECTIONS

As NAL continues to create full-text CD-ROMs and explores image transmission, the number of documents available in digitized format will continue to increase. Because AGRICOLA is the primary access tool for NAL collections, we will need to develop a method of recording the existence of a digitized version in the bibliographic record for a document. Ultimately, the image files could be stored on a device accessible through Internet so requesting libraries could simply download the images directly and not go through NAL's Lending Branch.

University libraries may want to take an active role in building the database and begin scanning documents at their own locations. Libraries could be assigned to digitize a certain set of publications, or could scan them as they fill ILL or in-house photocopy requests. The resulting image files could be centrally located, or more likely, distributed at locations around the Internet but with a central index to them.

The Integrated System of Database Creation and Computer-based Editing and Composition

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Abstract

We may use different software packages with different functions in creating databases, e.g., dBase, FOXBASE, Micro CDS/ISIS, MINISIS and so on. These software packages don't have the functionality of automatically indexing, editing and composition. They are not flexible for data input. Furthermore the databases created using this software are destroyed easily and their functions for inputting the data are not as strong as that of Personal Editor (PE) and WordStar (WS) software. However PE and WS software can not be used for database creation and information retrieval, but only has an editing function. Editing and composition software packages can only edit the data which have been input through PE software or WS software and can not fetch the data from the databases. This is the limitation for the software mentioned above. Through software development, we have integrated the three independent functions together and have realized an integrated system to create the database and edit and compose on the HP 3000 computer system, the IBM PC and its compatible computers. In our Integrated System we use CDS/ISIS for creating the database, "Keyin" software for editing and composition. But the two packages can not meet all our requirements for an integrated system. Therefore we have developed the following four software systems to meet our needs: 1. Computer-Assisted Indexing System. There are subject indexes for most of the reference books in China. But all the indexes are edited and sorted manually. We have developed a computer-assisted indexing system which enable the index entries to be formed automatically, and can be used to edit the indexes. There are the following two types of index entries formed by the computer-assisted indexing system: (1) Linear Type: The index entries have been formed automatically by using the nine function symbols. (2) The rotated type: The index entries have been formed automatically by using five function symbols. 2. The program for creating the item control number automatically. Most of the agricultural reference books or periodicals, such as bibliographies or abstracts must have their item control numbers. Previously the numbers were written manually for our published abstracts which took us a lot of time. Now our computer system can create the control number in the abstracts, classify and sort the data. 3. The program for data conversion and layout of publications. The information carried in the hardcopy published bibliographies or abstracts is retrieved from the database. The text and all the indexes need the programs to convert the data and do the layout. 4. The communication

program between PE or WS and CDS/ISIS. While establishing the database using CDS/ISIS, the data can only be input through the input function of CDS/ISIS, not by the data-input function of PE or WS. We have developed a program which is executed to form the index entries automatically, and convert the data into the database created by CDS/ISIS through its ISO 2709 Format interface.

In China many databases for information storage and retrieval have been set up on microcomputer systems by using various database management software (DBMS). But the DBMSs have no editing and composition functions which is their common shortcoming. Now various microcomputer software packages have been developed for compilation and composition abroad. Recently we have developed an integrated computer system to establish the database and perform editing and composition by using Micro CDS/ISIS and other programs. Because of the limitation of storage capacity for microcomputers, we load the data from our microcomputer system into our HP 3000 minicomputer to provide the online information retrieval service. Repeated work has been avoided, the publication cycle shortened, and modernization of editing and composition speeded up through the integrated system.

I. Database Management Software and Software for Editing and Composition

DBASE III, FOXBASE, and some homemade software using advanced languages are used widely in Chinese agricultural institutions and organizations. Besides the software mentioned above, the Micro CDS/ISIS software provided by UNESCO and enhanced with Chinese characters has also been widely used in Chinese libraries and information services for general information retrieval. It has such desirable features as universality, simplicity, flexibility and the ability to share information sources provided by mainframe computers, medium-, mini- and microcomputers through the conversion interface of the ISO 2709 standard record format. Now, we have created the Databases of the Bibliography of Agricultural Documents in China (DBBADC), the Chinese Agricultural Abstracts Database (Horticulture) (CAADH) and the Agricultural Scientific Achievements Database (ASAD) by using the CDS/ISIS software with the added function of data input in the Chinese language.

There are two types of software now in use in editing and composition: One has the simple function of composition and editing such as CWP-A, but can not meet the requirements of formal printing. They are used for word processing and office automation. The other has complete functionality and can meet the requirements of editing and printing. This type of software has been classified in the following three groups:

(a) Batch processing mode, e.g., Beihang Chinese Laser Composition Software (BCLCS), 'Keyin' Composition Software (KCS) for literature, and another edition for science, technology and mathematics.

(b) Interactive mode, e.g., Huangguang Electronic Editing and Composition System developed at Beijing University, Stone's 4S Software System for Editing and Composition, 'Keyin' Composition Software for Science and Chemistry Edition (KCSSCE), etc.

(c) Combined mode, which links the batch mode to the interactive mode and has the advantages of both modes, but requires advanced hardware.

We selected the 'Keyin' Composition Software for science, technology and mathematics.

II. Technology Needed in Realizing the Integrated System

The following three databases have been built supported by our integrated system:

(1) Agricultural Scientific Achievements Database (ASAD) supported by the CWP-A software.

(2) The Chinese Agricultural Abstracts Database (Horticulture). The hard copy abstracts can be produced directly from the two databases.

Now we are building up the integrated agriculture bibliographic database with 'Keyin' Composition software. In this paper I would like mainly to talk about the technologies and issues involved in the establishment of the bibliographic database.

1. Flow of the Integrated System

The CDS/ISIS software was used to set up the agricultural bibliographic database, which is composed of 32 fields. Data have been input to the computer according to needs. On one hand, these data which have been proofread three times, could be converted and loaded from the microcomputer system into the HP3000 minicomputer system for information retrieval by using an ISO 2709 format file. On the other hand, all data elements could be output from the database in the standard formats including the text, author index and subject index according to printing requirements. Unfortunately all the indexes can not be used directly in compiling the hard copy agricultural bibliographies and they need a conversion program to add some functional symbols for layout. For example, indications as to the style of calligraphy, the size of characters, paragraphing, and spacing should be added with functional symbols and converted into a machine-readable file for the composition software and then all the indexes can be edited and compiled. Finally an output file is created and transferred to the Sharp 11 Mode Laser printer and a final proof for offset printing is printed out.

2. Data Conversion Program

All the data in the integrated agricultural bibliographic database can easily form the text of hard copy bibliographies and be converted into the Keyin Editing and Composition Software format. The functional symbols, such as character font, size, etc., can be added in their proper places by using the output print format of CDS/ISIS. The output

text file can be directly used to form the final proof of hard copy bibliographies using the Keyin Editing and Composition Software.

For author index, subject index and retrieval concept index, the compilation function symbols can not be added to their output text files by using the output format in the CDS/ISIS software. It has to be specifically processed with a conversion program to form a specific sequential file. Then the sequential file can be processed by adding the compilation function symbols automatically, including the style of calligraphy, font and size of characters, the paragraphing, the carriage returns, etc., in order to form a file which can be processed by the Keyin Editing and Composition Software. Then a final proof print-out of the author index and subject index is compiled and composed. The subject category code index needs to be translated from the code into the actual terms. The conversion program has been developed by the author of this paper using the BASIC language. The program is simple in structure, concise in language and flexible in operation.

3. The Program for Creating the Serial Number of Items Automatically

The serial number of an item for the integrated agricultural bibliographic database can be produced by two methods: (a) Before input, all documents to be processed are classified and sequenced, and the item control numbers are written on the card by hand. Then the numbers are input into the microcomputer system. This method is called 'registration of serial number first, followed by input.' (b) Input the data first, then add the item serial number. This method is called 'input of data first, followed by item number registration.' The information for the bibliographic database is input through their own microcomputer systems by nine branch information centers separately. Then disks are sent to us by mail. Finally we load all data into our central database and merge them together. It is not possible for us to classify the data and assign the item serial numbers first. What we can do is to input the data first, then classify them, arrange them in sequence and assign them the item serial numbers. This procedure is quite inconvenient and moreover, if a serial number were miss-assigned, it would interfere with many other serial numbers. For these reasons, the author has developed a special program for creating the item serial number automatically. This program is very accurate and convenient to use.

We have tested the program on some 30,000 records for the hard copy *Bibliography of Agricultural Sciencetech Documents in Chinese*, and have proved that our program is reliable and convenient to use. Manual registration of the item serial numbers usually takes five days. Registration of the item serial numbers by a microcomputer only takes 2-3 hours.

4. Compiling the entries of a subject index on a microcomputer system.

The subject index is one of the important access points for users to retrieve information and one important basis for evaluating the quality of reference books. We use the microcomputer system to assist the indexing and create the entries of the subject index automatically. As a result, the work efficiency of indexing has been improved and the indexing is standard and reasonable.

5. Communication program between a microcomputer system and minicomputer system

Micro CDS/ISIS database software has an ISO 2709 standard record format conversion interface module, whereby communication can be conducted between mainframe, medium, minicomputers, and microcomputers. The Sciencetech Documentation and Information Center of CAAS has the Model 37 and Model 70 computers of the HP3000 Series. These computers can be used to build a database using MINISIS software, and mutual conversion of data with other computer systems can be conducted through the ISO 2709 standard format interface module. Both Micro CDS/ISIS and MINISIS have the conversion interface modules and they can communicate with each other. For using MINISIS to edit and compile the hard copy bibliographies, the text file must be output from the MINISIS database so the editing function symbols can be added automatically and then 'Keyin' software is used to edit them.

III. Summary

Through the integration of the Chinese Agricultural Abstract Database (Horticulture), the Agricultural Scientific Achievements Database and the Database of Bibliographies of Agricultural Documents in China and accomplishing editing and composition by computer systems, it has been proved that:

1. Integrating the establishment of a microcomputer database with the compilation and composition of hard copy bibliographies, has laid a foundation for the automation of editing and composition.
2. Since the data stored in the database can be used directly for compilation and composition of bibliographies, re-input of data can be avoided, time and labor can be saved and the publishing period can be shortened.
3. By using the program of automatic compilation and composition functional symbols, it is possible to change the style, fonts of characters and the format according to publication needs. Besides, by using the Laser Printer with 64 dot matrix and Scanning Printer with 300 Lines the final proof of the publication can be printed, hence the quality of the publication could be improved and the cost of publishing could be reduced.

Expert Systems for Agricultural Use: Recent Developments and Applications

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Abstract

Expert systems for agricultural problems are getting more and more important. The definition of the sense and substance of expert systems is followed by many references to documents on research projects in this area.

Indexing of the AGREP system using a personal computer serves as an example of agricultural documentation. The automatic analysis of project titles and abstracts using vocabularies and classification schemes helps to simplify the intellectual work of indexing and exemplifies an expert system with artificial intelligence.

1. What is an expert system?

By "expert" we understand a highly trained and informed person in a special field who gives skillful advice in subject-related problems at a low cost level. This information is arranged in expert systems in away that a non-expert can use the knowledge base of the expert to advantage. In general, the information can be provided in printed form, such as a vocabulary, a manual or a dictionary, easy to read by the user to solve the problem at hand.

Modern information technology helps to prepare computer-assisted expert systems for many users. The dialog between user and expert system in the computer consists of five main program steps. (Figure 1.)

1.1 Knowledge base

The knowledge base represents the encoded substantial expert knowledge, and means more than facts or factual data as is found in database units. The formulation of rules is required on the basis of experience gathered during many years and in accordance with laws of probability rather than of determination. The formulation of a rule may be as follows:

```
IF
  food_plant_producing (oil)
AND
  oil_is_in (seed)
AND
  seed_is (achene)
```

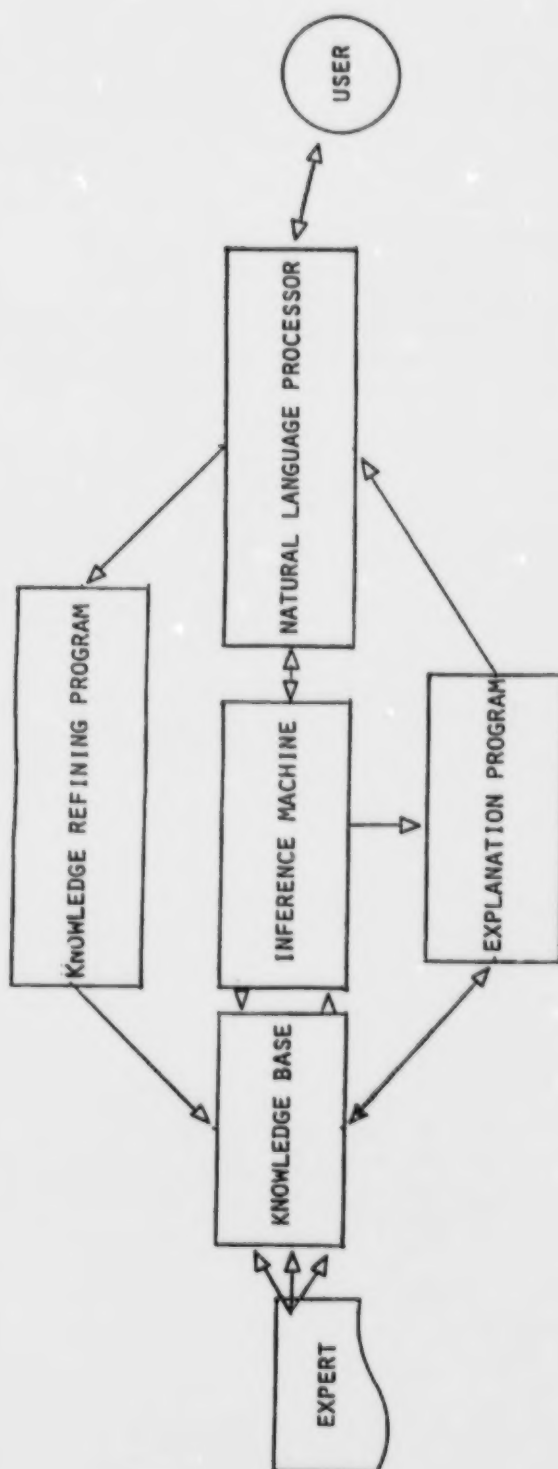


FIG. 1 EXPERT SYSTEM

```
AND  
plant_is (composite)  
THEN  
plant_is (sunflower)
```

The expert can formulate this or other rules for storing into the knowledge base by the computer programmer.

1.2 Inference machine

In order to enable users to employ the knowledge base, an inference machine is required so that facts and rules can be brought into conformity with the search question. (Figure 2.) Proceeding from the goal the user will search groups of objects first and then single objects using their so-called attributes along a decision tree. Following the decision tree from the base, to the objects, upwards to the goal, the user will select object groups by the probable attributes of the objects in view. (Figure 3.) Food plants can be classified by their producing chiefly starch, or oil, or protein, etc., and by the plant organs in which these products are found. See for instance, the following attributes for rape:

Rape (*Brassica napus* L.)

oil producing plant
oil in seeds
seeds in silique
cruciferae

Analogous definitions of food plants, forage plants, and non-food engineered plants with their attributes are also stored in the computer.

1.3 Knowledge refining program

This section of expert systems enables the user to include experience and new knowledge of the subject field into the program for updating.

1.4 Natural language processor

The natural language processor, an integrated part of the program, is often called a "user shell" and is meant to ease the man/machine communication for non-experts.

1.5 Explanation program

In interacting with the expert system the user may possibly be in doubt about the attributes assigned to an object. Using the explanation program he or she can retrace the documentation of the whole dialog to that point.

To exemplify the above, an expert system on crop plants, especially food plants, was developed. The system starts at the beginning of the knowledge base and proceeds in sequential operations until the searched objects are found according to their attributes.

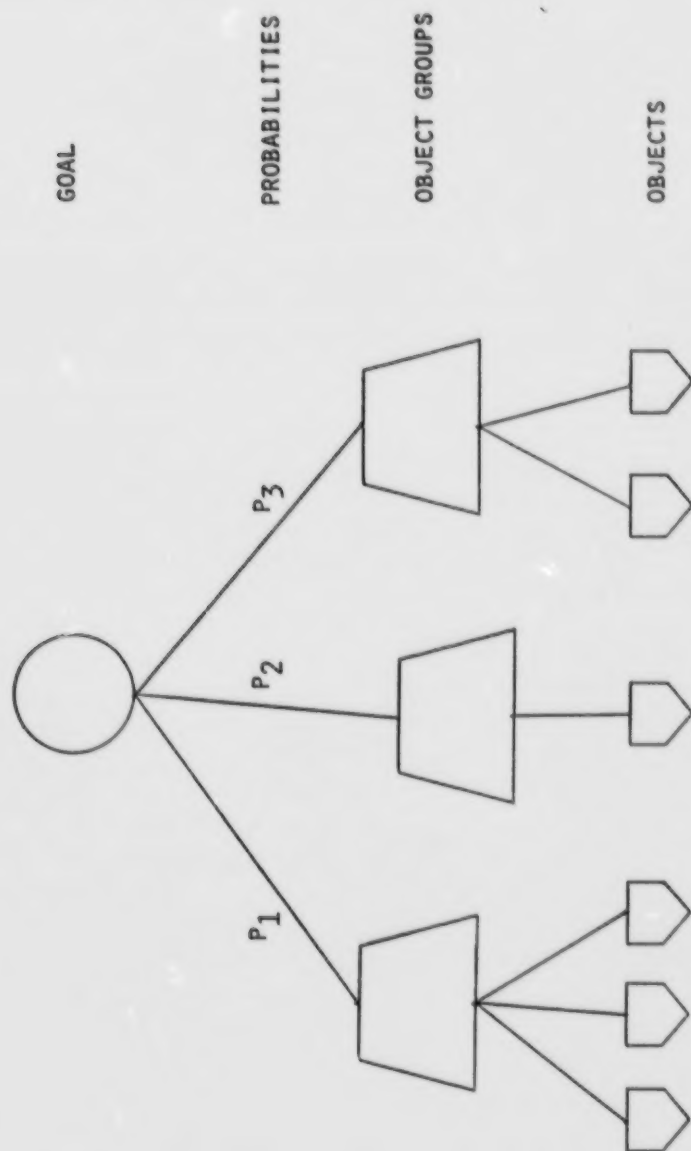


FIG. 2 DECISION-TREE OF THE INFERENCE MACHINE IN AN EXPERT SYSTEM

Other strategies are possible, but this procedure has proven to be the best for an inference machine. The knowledge programmer however is prepared to place the data in more or less useful arrangements. Objects searched rarely should not always be scanned first. There is the possibility of separating that part of the decision tree which contains the objects searched most often. After all it is difficult to define in a comprehensive knowledge base the attributes with the greatest utility. Consequently, statistical aspects are also relevant in verifying an expert system, because the relative frequencies of object searches contribute to the best structure of the knowledge base. The whole area of organizing the knowledge base is called "knowledge engineering."

2. Applications of expert systems in agriculture

Due to modern specialized diversification of farm production, expert systems and special knowledge will increasingly be of consequence. Just the restriction to special production engineering often entails the need to use a specific knowledge base assisted by computer implementation. In addition, databanks as subunits of the system, with graphs and windowing techniques are incorporated into complete expert systems. This applies likewise to plant and to animal production. Farm management refers to both lines and is in many cases very important.

The EDP-specialist, or the knowledge engineer in the case of expert systems, is dependent on the consultant to the projected knowledge system for designing the rules to be implemented in the computer. In case no permanent collaboration is feasible, at least a draft of the "human expert" should be available for including knowledge and experience into the computer program. Both experts are responsible for the correct performance of the system prepared.

In case two different experts see a specific problem under opposite aspects, it will be difficult to decide which of the two is the competent expert. If conflicting expert opinions are included, the user of the expert system is forced to make a decision and the system will then be deficient of authority and not be verifiable.

The first expert system -- MYCIN -- which proved very successful was prepared at Stanford University in the mid-1970s. The system enables a doctor to diagnose bacterial diseases in humans. To diagnose diseases either in humans or in animals or plants means to compare the symptoms in patients with those in the expert system's descriptions and to check their conformity. The MYCIN system proved a rapid and reliable aid for the doctor in identifying bacterial diseases.

Expert systems are often used in error detection of defective machines.

For a survey of knowledge-based systems in agriculture see the paper published by J.M. Pohlmann and A. Mangstl (Ref. 8). New projects are listed below:

2.1 Plant production

2.1.1 Dr. M. Strapper, Australia

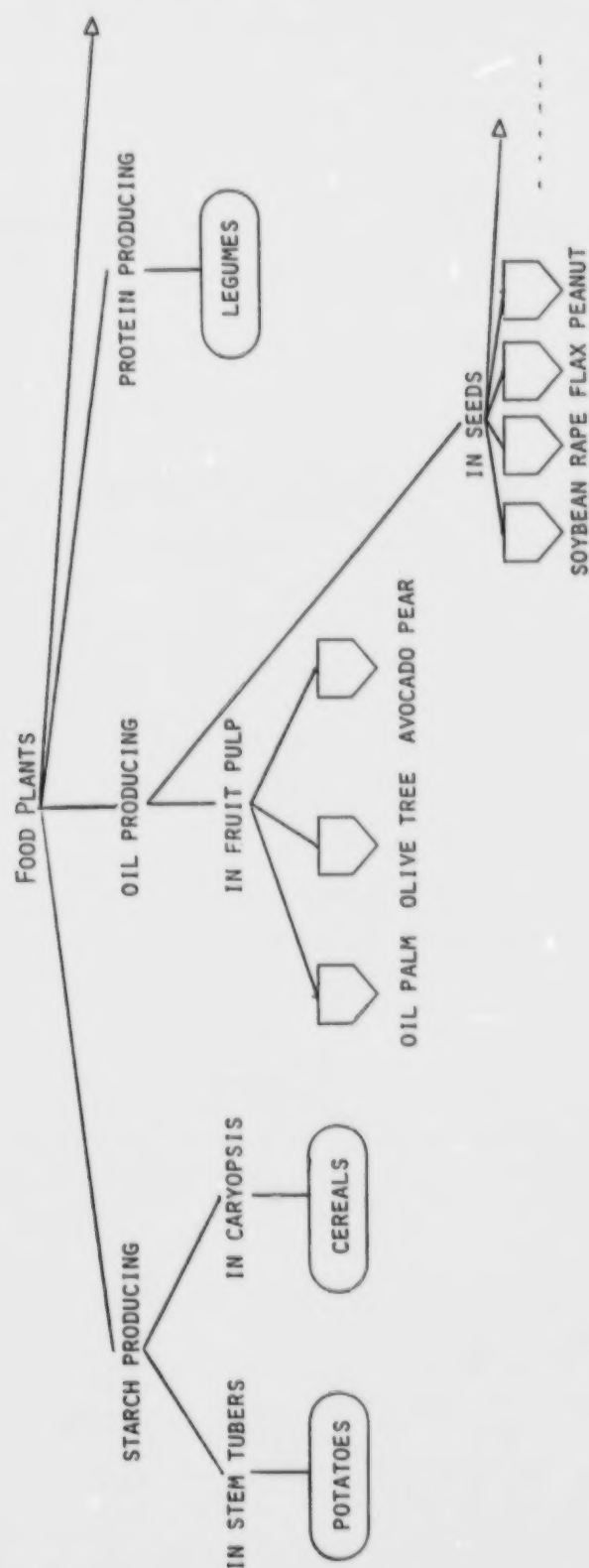


FIG. 3 A SAMPLE DECISION-TREE FOR FOOD PLANTS (BACKWARD CHAINING)

SIRAGCROP -- Bestandesführung im Getreide (Ref. 3)

2.1.2 Dr. LaRaw Maran, USA

WEAS -- Pflanzenschutzberatungssystem (Ref. 3)

2.1.3 Prof. Dr. I. Amir, Israel

CROPLOT -- gezielte Schlag- und Fruchtfolgeentscheidung (Ref. 3)

2.1.4 F. Le Corfec, France

ZEA -- Bestandesführung im Mais (Ref. 3)

2.1.5 S. Tolosa, France

PILAR -- Aufbau und Darstellung einer Wissens- und Regelbasis für die Bestandesführung (Ref. 3)

2.1.6 J. Le Renard, France

SEPV -- Diagnose im Pflanzenschutz für 17 Kulturarten (Ref. 3)

2.1.7 T. Hoshi, Japan

Krankheits- und Schädlingsdiagnose bei Tomaten (Ref. 3)

2.1.8 R. Cervo, Italy

Diagnose von Krankheits- und Schädlingsbefall bei Oliven (Ref. 3)

2.1.9 M. Ruckert, U. Voges, J. Frahm, FRG

WIFEX -- Winterweizen Fungizid Experte / Ein wissensbasier-basiertes System zur Ermittlung des Einsatzpunktes von Fungiziden gegen die Halmbrückerkrankung in Winterweizen (Ref. 5)

2.1.10 S. Poths, J.M. Pohlmann, FRG

FROTEX -- Prototyp eines Expertensystems zur Planung umwelt gerechter Fruchtfolgen (Ref. 5)

2.1.11 J.M. Pohlmann, FRG

HERB-OPT -- ein Expertensystem zum umweltgerechten Einsatz von Herbiziden (Ref. 5)

2.2 Animal production

2.2.1 P. Leuschner, FRG

Klimaregelung in Broilerställen (Ref. 3)

2.2.2 E. Vrankem, Belgium

Entscheidungshilfen in der Schweinehaltung (Ref. 3)

2.2.3 Dr. O. Kroll, Israel

Herden- und Fütterungsmanagement in der Milchproduktion (Ref. 3)

2.2.4 Dr. A.A. Dijkhuizen, The Netherlands

Herdenmanagement in der Sauenhaltung (Ref. 3)

2.3 Farm management

2.3.1 Prof. Dr. W.G. Uhrig, USA

Die Auswahl geeigneter Vermarktungselternativen bei Getreide (Ref. 3)

2.3.2 Prof. Dr. B. Öhlmer, Sweden

Die Wirtschaftlichkeitsanalyse für einen landwirtschaftlichen Betrieb (Ref. 3)

2.3.3 Datev eG

Expertensystem für Finanz- und Steuerplanung (Ref. 3)

2.3.4 R.B.M. Huirne, The Netherlands

Wirtschaftlichkeitsanalyse für die Schweinehaltung (Ref. 3)

3. Automatic indexing with thesauri and classification schemes

The AGREP database (AGricultural REsearch Projects in the European Communities) is based on the English-language research projects of the EC-member countries. The problem is to include the project titles and abstracts so that they are easily retrievable with a technical index. A four-facet classification scheme has been introduced recently:

Facet A.....Activities
 Facet B.....Subject areas
 Facet C.....Fields of science
 Facet D.....Fields of research

and the AGRIS/CARIS Categorization Scheme.

These classification schemes are intended for AGREP indexing.

On behalf of the EC Commission a PC program was prepared at Datacentralen, Copenhagen, which is to support the still intellectual indexing work of experts responsible in the EC-member countries. The heavy searching in thesauri and vocabularies is done much more quickly with the help of a personal computer. (Figure 4.)

The CABI (Commonwealth Agricultural Bureaux International) vocabulary is the largest English-language agricultural thesaurus in existence. It serves as the basis for analyzing project titles and abstract texts after the removal of stopwords, which are supplied by a special list. Words found neither in the *CAB Thesaurus* nor in *AGROVOC* (the FAO thesaurus) are simply skipped. The indexer marks the composite English terms first, the so-called noun-phrases, for example "animal breeding," and then begins with the automatic text analysis.

The CABI descriptors are arranged in parallel with the corresponding *AGROVOC* terms. This concordance list shows that general terms from *AGROVOC* have been assigned repeatedly to many different descriptors of the *CAB Thesaurus*. But since AGREP indexing needs *AGROVOC* terms, these are taken as controlled terms. After automatic determination of the controlled terms, additional terms can be added or some of them can be deleted manually. All of them should be *AGROVOC* terms as these are connected in a list with the subject areas (B-facets), fields of science (C-facets) and fields of research (D-facets).

<i>AGROVOC</i> Descriptor	Facet
dogs	B4920 (Domestic pets and zoo animals)
climatology	C2500 (Meteorology and climatology)
recycling	D4440 (Transport and handling)

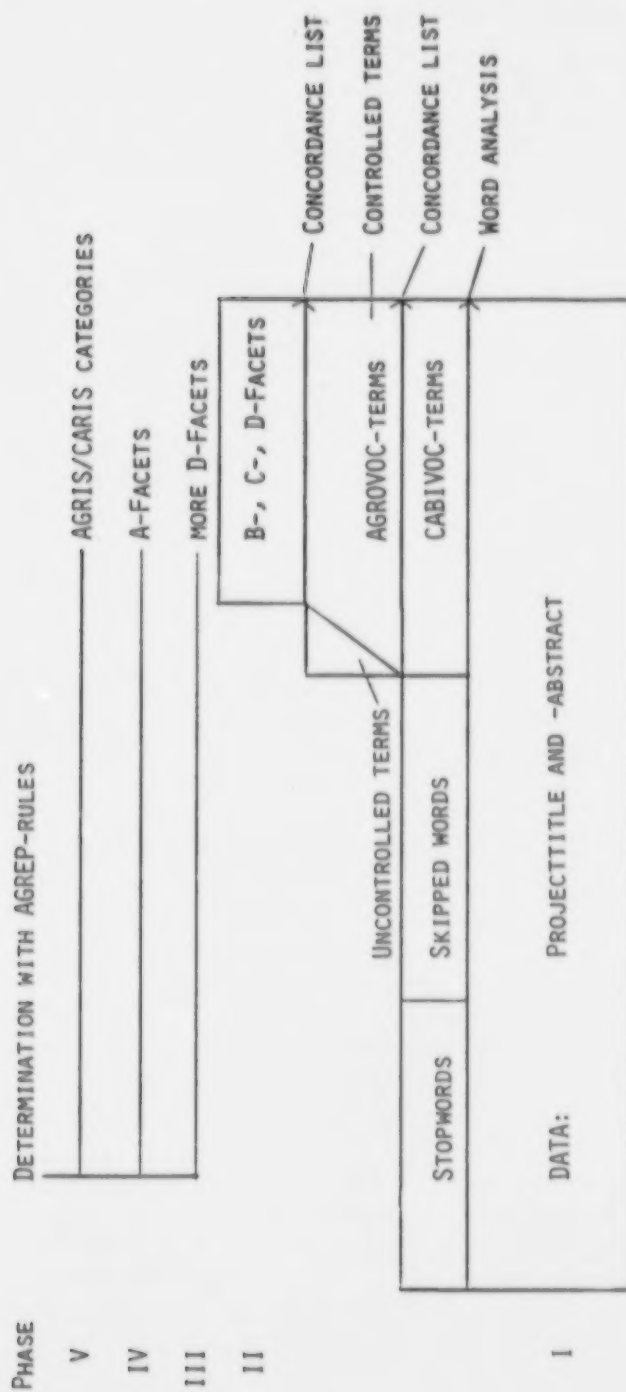


FIG. 4 AUTOMATIC INDEXING OF AGREP

In the following phrases logical rules are applied to find more D-facets and activities (A-facets) as well as AGRIS/CARIS categories.

Phase III

IF	B3	(Crops)
	AND	
	B5910	(Specific non-domestic plants)
THEN	D2430	(Weeds and weed control)

Phase IV

IF	B6	(Man-made resources)
	AND NOT	
	D4	(Engineering, technology, harvesting, storage, processing, transport)
THEN	A4100	(Determination of properties of products)

Phase V

IF	B3	(Crops)
	AND	
	C3600	(Population biology, population dynamics, population genetics)
OR	C3700	(Ecology - aerobiology, bioclimatology, hydrobiology, symbiosis)
THEN	F40	(Plant ecology)

After each of the five indexing phases a prescribed sequence of facets and categories can be initiated by hand, or performed automatically before the project is put into the READY status. The program although in a test stage is very promising. It has a large user shell. Besides, both concordance tables *CAB-AGROVOC* and *AGROVOC-Facets* B, C, and D as well as all the other simple classification schemes can easily be displayed and marked during indexing so that they are included in the project field.

The *CAB-AGROVOC* concordance index which was developed cooperatively by the AGRIS Processing Unit in Vienna and the National Agricultural Library in the United

States, is especially useful for intellectual indexing. A simple special program enables the search of descriptors in one or in both vocabularies at the same time. It will likewise prove a helpful tool in descriptor search for information retrieval in the three English-language agricultural databases AGRICOLA, CAB Abstracts and AGRIS.

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A Study of the Khonkaen University Research Information System

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Abstract

In Thailand, institutions of higher learning conduct research for the socio-economic development of the country. Khonkaen University, a regional academic institution in the northeast, is in the process of setting up a formal research information system, even though its teaching staff has already monitored many research projects as well as many on-going projects. A study of the existing research information systems at Khonkaen University and those of other state universities, government, and non-government agencies was made with a particular focus on data structure, computing equipment and software. A series of interviews with responsible research units, in addition to a study of published and unpublished documents, was used to gain an overview of the research information systems of Khonkaen University as well as those in Bangkok, the capital of the country and the center of education, business, communications, etc. An electronic linkage between the universities and scientific and technological government agencies, is not yet established. This is due mainly to telecommunication costs, technical problems, and a shortage of equipment. However, it is planned, as a first step, to make a link between computer centers in the universities in Bangkok. This should be established by late 1989.

A proposed formal research information system for Khonkaen University, giving better control of research funds, projects, expertise and equipment could be based on existing resources there with some additional computing equipment.

Introduction

In Thailand, the agencies responsible for research are mainly governmental; little research is done by the private sector. Nearly all fourteen ministries are involved in research but the degree of involvement varies from ministry to ministry, depending on subject priorities. Only the Ministry of University Affairs is engaged heavily in research projects. At present, there are sixteen state universities and institutions and eight private universities under the Ministry of University Affairs. Of these, there are three state regional universities, namely Chiangmai University in the north, Khonkaen University in the northeast, and Prince of Songkla University in the south.

Khonkaen University

Khonkaen University was founded in 1964 with one objective of becoming the academic center for the northeast. This region occupies one third of the country's total area. It is densely populated and the land is rather poor. The University offers a wide range of subjects including education, humanities, social science, natural science, medical science, health related subjects, engineering, and agriculture. The student body is about 6,600. Khonkaen University plays a very important role in producing highly-skilled human resources for the development of the country in addition to transferring knowledge and technology to and from the northeast, conducting research for economic growth and for the well-being of the public.

The need for a research information system

The University has proposed setting up a formal research information system although there are informal systems already in existence. Each year the University receives research funds from the government for its research projects. It also receives funds from foundations, international bodies such as the United States Agency for International Development (USAID), the Canadian International Development Agency (CIDA), and the Ford Foundation. The University has good control over government funds but not over funds from the other sources. This is because the external agencies contact the faculty or individuals directly. Until recently the University did not have a formal focal point where the faculty members/researchers could obtain information on on-going, completed, or projected research projects. As a result, information on research projects had to be sought from various faculties or institutions or the libraries.

This situation has greatly concerned the administration as well as researchers. As planners, they need timely and accurate information on all research projects (completed, on-going, and proposed), research expertise, research equipment, research funds, and funding agencies in order to formulate a policy for research activities, to avoid duplication of research and to foresee the directions the University should take. The researchers themselves seem lost because they do not know where to start. Or if they know, they have to spend lots of effort to consolidate information in order to begin a new project.

The Office of the Vice President for Research Affairs which was established in late 1986 and is directly responsible for research has tried to solve these problems by first organizing a seminar entitled *A Management System of Research and Development for Khonkaen University* in 1987. The objectives of the seminar were: 1) to identify a database system which would be used by all participating units of the University; and 2) to use computers in processing, storing and retrieving data. The seminar was very successful and the participants recommended that a computerized database be created containing data on researchers, projects, equipment, funding and proposals. They felt that status data and scientific and technological index files are of lower priority but also recommended, and that the systems should eventually be electronically linked with those of other agencies in the northeast and in other parts of the country.

Data gathering

To implement the above recommendations, the University sought financial assistance from the International Development Research Centre (IDRC), Canada, which engaged two consultants (one local and one foreign) to study the present system and to make recommendations. At Khonkaen University, the study visits were made to the Faculties of Science, Public Health and Agriculture; the Research and Development Institute, the Water Resources and Environment Institute; the Instruction Research Center (Library); and the Computer Center. The visits in Bangkok included the National Research Council of Thailand; Thailand Institute of Scientific and Technological Research (TISTR); Chulalongkorn University; Kasetsart University Library; Asian Institute of Technology Library and its Regional Computer Center; National Electronics and Computer Technology Center; and Thailand Development Research Institute. Some faculties and institutes were chosen for site visits because it was known that they currently had systems in place.

The following are samples of basic questions asked during the visits:

1. Do you have a research information database?
2. If you have one, is it a manual or a computerized database?
3. What research information do you keep? Researchers names or completed projects or on-going projects?
4. What is the size of the database (no. of records)?
5. What hardware do you use?
6. What software do you use? Why did you choose this software?
7. What is the data structure?
8. What are the bibliographic data elements of each record?
9. Does the database contain information other than research?
10. Who is responsible for the input?
11. Is the database accessible to other organizations via electronic linkage?
12. If you do not have a database now, will you be considering one in the future?

Findings

It was found that at Khonkaen University not all places visited have computerized research records although each place has at least one IBM PC or compatible. The principal use of the microcomputer is for research data manipulation. The Faculty of Public Health keeps only titles of research projects along with other data. The Faculty of Science has created a database of completed research projects while the Research and Development Institute while concentrating mainly on rural development also maintains a research projects database. The Library which is one of four components of the Instruction Resource Center has records of research reports of the university together with other records in the book database. On the matter of subject coverage, each faculty has interest in its own projects and except for the library the database is rather small. The Mini/Micro CDS/ISIS software is widely used for this bibliographic database. Since each faculty or institute has created its database independently, there is no common data structure. Furthermore, most PCs are not linked to the University Computer Center which uses a VAX 11/780 (16 Mb). At present only the Research and Development Institute (rural development) is connected to this Computer Center.

A similar situation exists at other universities such as Chulalongkorn University, and Kasetsart University in Bangkok. They both use microcomputers and the Mini/Micro CDS/ISIS program for their research projects' databases. The only difference is that the former maintains records of completed projects of the university while the latter only on-going projects on agriculture.

Both the National Research Council of Thailand (NRCT) and the Thailand Institute of Scientific and Technological Research (TISTR) which deal directly with research activities, have minicomputers and several PCs. NRCT is the national depository of research reports and on-going research projects. This database contains about 15,000 projects across the country. The three main components of the records are: 1) institutions, 2) researchers, and 3) projects. The software being used on its minicomputer is UNIFY.

The Thai National Documentation Center, a component of TISTR also uses Mini/Micro CDS/ISIS for its bibliographic database in addition to MINISIS on a Hewlett Packard 3000. The Asian Institute of Technology Library has lengthy experience with CDS/ISIS software on its IBM mainframe. Its book database also contains research reports.

However, all government bodies have included the research activities in their annual reports, thus the researchers use these publications as one of their sources.

It may be concluded that there is no one unified research information system at Khonkaen University nor at other institutions of higher learning. Microcomputers are widely used because they are affordable. For the bibliographic databases, the most popular software is Mini/Micro CDS/ISIS which UNESCO distributes free of charge. There is no electronic network as yet.

Recommendations

To quickly improve the research information system at Khonkaen University, will not be too difficult. Since IBM PCs or compatibles and Mini/Micro CDS/ISIS are extensively used, the Office of the Vice President for Research Affairs, as the official focal point, may first be equipped with: 1) One full-time officer whose duties are to collect data on researchers, projects, funds, equipment, and to input data; 2) An IBM PC AT or compatible with a printer; 3) Mini/Micro CDS/ISIS software (latest version). This office may request assistance from the University Computer Center to design the data structure for the research database and to train the officer-in-charge. Certainly the data structure must be agreed upon by the research community before it is implemented. It is also advisable to design the data structure to be exchangeable with those available at other universities/institutions. Once this new database has enough records of projects for different faculties/institutes to be given back their contribution for comments, coordination and cooperation between the responsible units and the researchers will be significantly enhanced. They will definitely realize that coordination among themselves will greatly improve the sharing of information on research activities at the University and eventually across the country. In the early stages, the faculty members or researchers will have to contact this office in person or by telephone but once the machine is linked to the University Computer Center they will be able to access the database online.

If the institutions which now have a manual file of research projects are interested in developing a computerized database, the Khonkaen University Research Information System will be a good case study. In cases where existing databases use programs other than Mini/Micro CDS/ISIS, the experience of this University will still be of benefit. They may decide to convert to CDS/ISIS in order to be part of the network of research systems.

Future

In order to be able to exchange information about research projects among the research community throughout the country, the Ministry of Science, Technology and Energy (MOSTE)/National Electronics and Computer Technology Center (NECTEC) plans to set up a linkage among the science and technology institutions' databases electronically. The link is definitely planned initially among four institutions in Bangkok and later those in Bangkok and the provinces. As such the Khonkaen University Computer Center will be linked with other institutions' computer centers, especially the National Research Council of Thailand, across the country.

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Establishment of the Chinese Agriculture Abstracts Database

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Abstract

This article describes the procedure of establishing the database of Chinese Agriculture Abstracts with MINISIS software on minicomputer and Micro CDS/ISIS software on microcomputer, including a connected sequence of building the database, typesetting the journal publication, and producing the subject index by computer.

I. Information Source

Chinese Agriculture Abstracts (CAA) is a set of journals which publish comprehensive abstracts in agriculture. The publication of these journals was started in 1980 by the Sciencetech Documentation and Information Centre of the Chinese Academy of Agricultural Sciences. These journals are bimonthly and provide about 11,000 abstracts, including a subject index at the end of each year. It includes six individual journals: *Soil and Fertilizer*, *Veterinary Medicine*, *Animal Science*, *Horticulture*, *Plant Protection*, and *Grain and Economic Crops*. At present, about 1,000 different periodicals are available for abstracting by the editorial board. Of these, 400 are considered to be key periodicals. CAA concentrates on collecting and reporting the literature and documents of agriculture as well as those that are closely related to agriculture in our country. The abstracts are made from articles in periodicals, journals, trade magazines, monographs, conference proceedings, etc. The statistics show that articles from periodicals, trade magazines and journals are the main source of information.

II. The Main Concept of the Database

The computerized database of CAA is a Chinese character abstracts database built on an HP 3000/70 computer with MINISIS DBMS (the software was kindly provided by IDRC). The Database of Chinese Agriculture Abstracts (DB CAA) is in fact a comprehensive computerized information processing system which possesses the capabilities of compiling indexes and database retrieval.

The establishment of DB CAA began in 1988. At the beginning, we directly input the data on an HP 3000/37 computer, also all the data were saved in the HP 3000/37 computer every day. After working in this way for a period of time, we found that the input speed of the Chinese characters was slow, the computer system's expense was high and that Chinese character processing in personal computers had improved.

Because of a personal computer's fast input speed, simple operation and convenient management, we determined to switch to using a personal computer as the input device.

The DBMS software we used in the personal computer to build the database is Micro CDS/ISIS which was developed by UNESCO. It allows us to build and manage structured non-numerical databases. Its functions are similar to and compatible with MINISIS software. It provides a number of functions for the establishment of a database: definition, modification, input and output, etc. On the basis of such conditions, we have developed a flowchart of the system. Figure 1 shows the flowchart of the operation of this system.

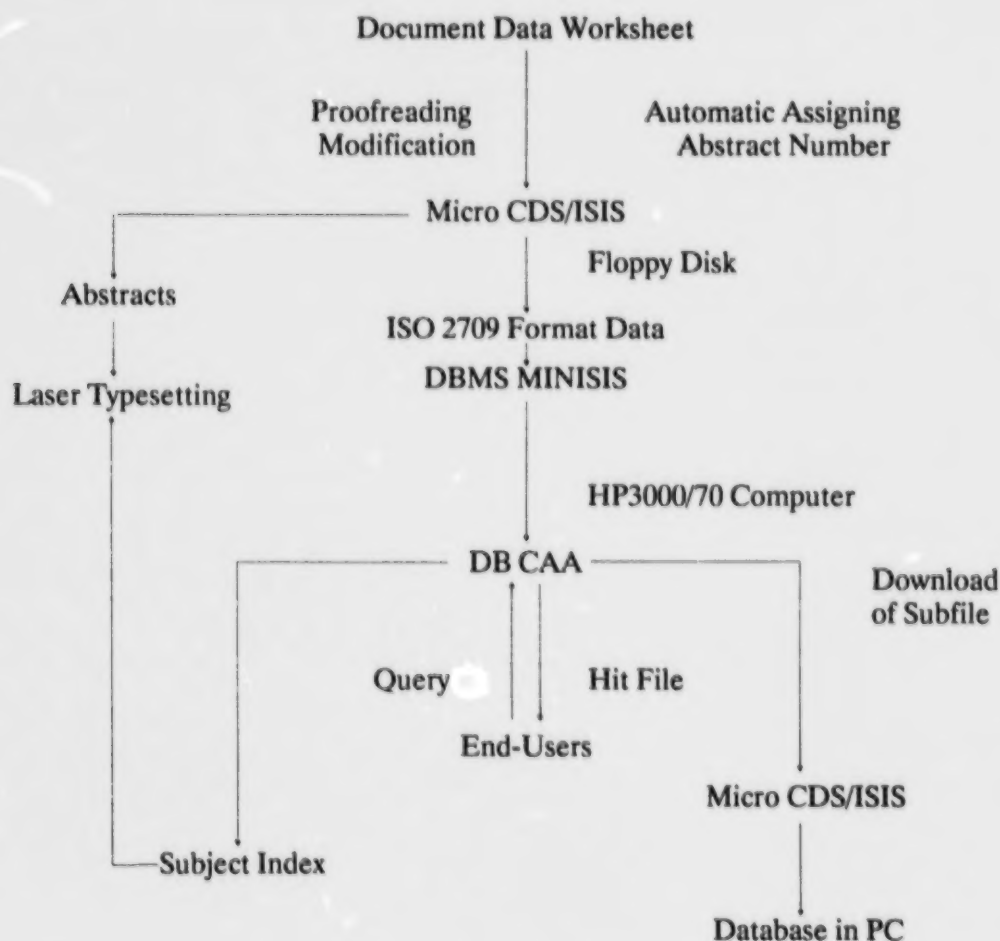


Figure 1. System Flowchart Diagram of DB CAA

III. Realization Of The Establishment Of DB CAA

Each record of the DB CAA is designed to include 25 fields. These fields include the contents of the abstracts. It is searched by classification number, author, keywords in title, descriptors and feed terms. During retrieval, users can set up Boolean expressions including "logical OR, logical AND, logical NOT, left-truncation and right-truncation" to retrieve information from the database.

During the building of DB CAA, we wrote a program which can assign abstract numbers by computer according to the classification number of each record. In this way, we can not only reduce the work burden of editors, but also avoid errors. This skill is a simple one. See Figure 2.

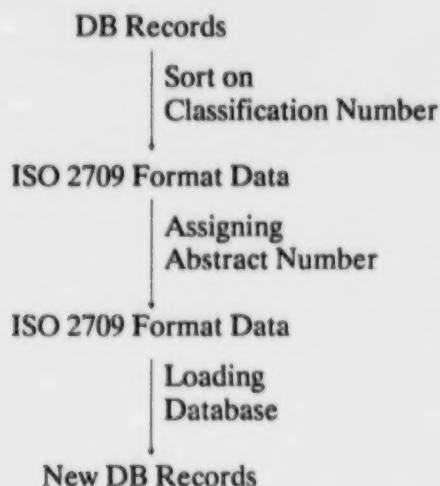


Figure 2. Flowchart Diagram on Assigning Abstract Number by Computer

Because of the complex structure of the database when using Micro CDS/ISIS software, we avoid calling database records directly. But we can call ISO-2709 formatted data as intermediate forms. It is a text file and easy to process. After having abstract numbers assigned by the program, the ISO-2709 format file becomes a new file which includes abstract numbers. It forms a new sequence of records in the database after the file is loaded into the master file in the minicomputer.

As subsidiary products, we also typeset the abstracts journal during the creation of DB CAA. We use the data from the database records to typeset the journal publication so as to avoid unnecessary repetition in data inputting. There are two kinds of typesetting software available in our country. One kind of software is used for Office Automation (OA), but it is not suitable for printing journals. Another kind of software is fit for

publishing. It includes batch processing, alternative type fonts and combinations of type. The software we chose is "KeYin" which is batch processing software. The procedure for typesetting the journals is described briefly as follows:

Using a formatting language with Micro CDS/ISIS software, we insert the functional symbols of typesetting software in the output file, e.g., size of the printed character, form of the printed character. After a file to be edited is produced by Micro CDS/ISIS, we artificially interpose some characters which are not inputted during data input, such as symbols of molecular formulae. When the file has been edited, the computer is used to automatically typeset the file and a typeset file is produced. At last, the typeset file is printed by HP LaserJet II printer. We produce a subject index of each abstract journal at the end of each year. Now the Chinese characters are classified into two levels. The first level is sorted according to phoneticism. The second level is sorted according to the basic structure of the Chinese characters, such as strokes, etc. Because of this, the output index file is not fit for publishing. We use the thesaurus management program of MINISIS software to solve this problem. Both first and second level Chinese characters (a total set of 6,763 Chinese characters) and other character symbols are sorted according to the sequence of the *XinHua Dictionary*. We then rebuild a new index comparison table on MINISIS. During sorting, the new table is used to replace the original table. Thus, we have basically solved the issue of sorting Chinese characters.

At present, the content of the database includes the following disciplines (corresponding to the printed abstract journals): soil and fertilizer, veterinary medicine, animal science, horticulture, plant protection, grain and economic crops. Through our efforts, DB CAA now contains about 5,400 records. We estimate that DB CAA will reach about 14,000 records at the end of this year.

IV. Problems

We have encountered many problems during the past two years. Some have been solved, others remain unsolved. The first problem is the shortage of Chinese characters in the computer. About sixty Chinese characters are missing in the DB CAA which has been loaded into HP 3000/70 computer. The second problem is the excessive artificial interpositions in the original typeset file during editing (on the basis of the contents of the abstract). The second problem refers mainly to symbols of molecular formulae and the italics of the Latin alphabet which the computer can hardly determine because they are in the text of the abstracts. The last problem is how to index a Chinese character which has multiple phoneticism. In a computer, the sequence of the phoneticism of a Chinese character is one-to-one. The computer can't determine how to phoneticize a character. These problems may be solved later when new software is available.

V. Conclusions

The establishment of the Database of Chinese Agriculture Abstracts has great significance because it is the first Chinese character agriculture abstract database in our country. We provide retrieval services while building this database. Users and readers

are welcome to query and test DB CAA. In so doing, we can promote both our work and the development of agriculture in China.

On the CAB Thesaurus

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Abstract

This paper presents an outline of major thesauri in agriculture all over the world, analyzes the characteristics and position of the CAB Thesaurus (CABT) and concludes that it is the thesaurus of the largest scale, and the widest influence as well as having many distinguishing features in the field of agriculture. The paper points out that the thesaurus integrates an alphabetical display with the functionality of a hierarchical index, a permuted index and an index of identifiers and gives a complete display of hierarchical relationships in its alphabetical list, which breaks traditional models of thesauri. Moreover it observes that while this new kind of structure is concise, practical, convenient to use, and is one from which people can obtain a great deal of information by one look-up, the structure makes the thesaurus too lengthy to retrieve from easily on the basis of disciplines and specialties. The paper also evaluates the performance of the CAB Thesaurus with three standards (i.e., connectedness ratio, accessibility measure, and equivalence ratio) and indicates that the structure of the thesaurus is adequate, but non-descriptors in it are insufficient. In displaying hierarchical relationships and preferring the popular name over the Latin scientific name, it obviously violates international standards for the establishment of thesauri, which may cause confusion to users.

CAB ABSTRACTS and the CAB database are the most common information retrieval tools used by agricultural scientific and technical researchers in China. However, the *CAB Thesaurus (CABT)*, as the indexing language of CAB ABSTRACTS and the CAB database, is less well-known in China, even the agricultural libraries and information services know little about it. This paper intends to introduce the characteristics of *CABT* and to evaluate its structure and cross references so as to provide guidance to numerous agricultural scientific and technical researchers and to those who will themselves establish thesauri.

1. Characteristics and position of CABT

To meet the needs of indexing and retrieving agricultural documents, some agricultural information agencies in European and American countries, international agricultural libraries and information services have established and published a number of thesauri covering agriculture and its related disciplines since the 1960s. According to *Thesaurus Guide: An Analytical Directory of Selected Vocabularies for Information Retrieval* there are eighteen English language thesauri in agriculture and its related disciplines which are available now in the world. Among these, there are five which include over 10,000

terms, 11% of the total number of large English thesauri included in *Thesaurus Guide*. These are as follows:

- (1) *A Multilingual Thesaurus of Agricultural Terminology (AGROVOC)*, compiled by FAO and CEC, 1982, 1st ed., 7 vols, number of descriptors: 8,660, number of non-descriptors: 6,940.
- (2) *Agricultural/Biological Vocabulary (A/B Vocabulary)*, compiled by NAL of USDA, 1967, 1st ed., 2 vols, number of descriptors: 11,800, number of non-descriptors: 6,700.
- (3) *CAB Thesaurus (CABT)*, compiled by CAB, 1983, 1st ed., number of descriptors: 40,800, number of non-descriptors: 7,200. 1988; 2nd ed., number of descriptors: 47,400, number of non-descriptors: 8,600.
- (4) *Canadian Agriculture Thesaurus (CAT)*, compiled by Agriculture Canada, Research Branch, Research Program Service, 1977, 2nd ed., 4 vols, number of descriptors: 24,000, number of non-descriptors: 12,000.
- (5) *FAO Index Terms*, compiled by Documentation Processing Section of FAO, 1981, 2nd ed., 2 vols, number of descriptors: 14,000, number of non-descriptors: 1,000.

From what is listed above, we can clearly see that *CABT* has the most important position among *CABT*, *AGROVOC* and *Agriculture/Biology Vocabulary* which are the most famous agricultural thesauri in the world.

CABT is the largest agricultural thesaurus in the world at present. The number of terms in *CABT* is much greater than the sum of *AGROVOC* and *A/B Vocabulary*. The first edition contains 48,000 terms, in the second edition published in 1988, the number has gone up to 56,000. According to statistics from the *Thesaurus Guide*, there are eleven English language thesauri containing more than 20,000 terms, *CABT* stands in the top position, other famous large thesauri such as *TEST*, *Thesaurofacet*, *MeSH*, *INIS*, *EURATOM*, and *NASA*, etc., fall behind it.

CABT has the broadest subject scope among all agricultural thesauri in the world. It covers agriculture and almost all of its related disciplines. Besides agricultural science, forestry, and animal husbandry, it contains agricultural economics, soil technology, aquaculture, veterinary science, food and nutrition, agricultural environmental pollution, agricultural education and extension and so on.

The Commonwealth Agricultural Bureaux (International) is the greatest agricultural information service in the world. It publishes 46 abstract journals every year, in which about 150,000 papers in agriculture collected from many countries in the world are reported. The starting point for the *CAB Thesaurus* was the *CAB ABSTRACTS Word List* (1978), drawn up on the basis of indexing and retrieving over 2,000,000 agricultural articles and the frequency of occurrence of terms used in the subject index of the CAB abstract journals. And then, with reference to FAO's *AGROVOC* and the CEC's

thesauri on veterinary science and agricultural economics, CAB published *CABT* in 1983. Thus it has literary warrant and meets the demands of agricultural information work.

CABT is of wide adaptability and strong practicality, so it is well appreciated by numerous agricultural scientific and technical researchers. It has great influence in English-speaking countries as well as non-English countries. In 1985, NAL of the U.S. began using *CABT* as the indexing language of its AGRICOLA database. An additional 1,500 terms for subjects covered by AGRICOLA but out-of-scope for CABI (mainly human ecology, food service, and food technology) were admitted into *CABT* at this time and each was marked so as to be identified by users. Thus *CABT* has been widely employed by two of the three largest agricultural bibliographic databases in the world. The important position of *CABT* is further affirmed in agricultural information services, and it will have greater and greater influence on the indexing and retrieving of agricultural literature.

2. The structure of *CABT*

The structure of thesauri has gone through a progression from simple to complex, and has gradually formed a basic model, i.e., a thesaurus consists of an alphabetic list, a category list and a hierarchy index (or hierarchy graph). In addition to all these components, some thesauri contain an index of identifiers, a permuted index, a bilingual concordance or an alphabetic index, etc. The structure of thesauri therefore has become more and more complicated. For users who want to look up a descriptor and the hierarchy in which it belongs, it is necessary to search more than one part of a thesaurus, which makes the speed of indexing and retrieving slow down.

Since the 1970s, the designs for thesauri have tended to a new direction, i.e., the functionality of thesauri has strengthened and the structure has simplified. Besides *The Thesaurifacet* established by Jean Aitchison in 1969, *CABT* is another typical example of this new tendency.

The entire *CABT* has only an alphabetic list without any other components. It displays all hierarchical relationships in the alphabetic list, which actually means that the hierarchy index is integrated into the alphabetic list. It also includes identifiers and arranges them together with common descriptors, so a separate index of proper names can be omitted. Thus it integrates aspects of a hierarchy index, an index of identifiers and a permuted index within the alphabetic list and forms a new kind of structure.

Before *CABT* was published, some thesauri such as *TEST* (1967), *NASA* (1967), and *JICST* (1975) had employed the style which displays all hierarchical relationships, but they did not break the traditional model at all, they retained either a hierarchy index or permuted index and category index. However, *CABT* boldly abandons the hierarchy index, permuted index and category index, and draws the quintessence from various thesauri and then makes some improvements in the style of display. By displaying all hierarchical relationships in its alphabetic list, the hierarchical structure of *CABT* is so

distinct and directly perceived that users can conveniently find all the superordinate and subordinate terms under one term, then choose any of them. The unitary structure consisting of an alphabetic list as mentioned above is convenient to master and use, in one look-up users can obtain a maximum of information and avoid searching in several parts of the thesaurus.

However, the structure and the display still have three problems as follows:

1) **The thesaurus is lengthy and costly.** Although it omits a hierarchy index, a permuted index and some other components, its size is still greater than that of traditional thesauri. Along with the extension of subdivisions of hierarchy and more terms being included in the thesaurus, the size of a thesaurus displaying all hierarchical relationships will be larger and larger.

2) **A whole hierarchy can be displayed under its top term, but the hierarchy can not be displayed completely under any other terms.** So if users want to know a whole hierarchy clearly, they must seek under its top term. For example, under the term "maize," the broader term "cereals" and the narrower term "sweetcorn" can be found, but some other terms which belong to the same hierarchy such as "wheat," "rice," and "sorghum" can not be found. Under the term "sweetcorn" even "flint corn," and "dent corn" can not be found. Only under the top terms such as "cereals" or "forage crops" can the whole hierarchy be displayed.

3) **CABT only has an alphabetic list without a classified list.** So it is not convenient to browse various subjects on the basis of disciplines and specialties and to retrieve on a large-scale. All the CAB ABSTRACTS journals have been set up under a broad classification scheme. By gathering and collating all these classification systems, a classified list could probably be established.

3. The cross-reference system of CABT

CABT (2nd ed.) consists of 56,000 entries. The chief component of each entry is its cross-references. Besides those, a few of the entries contain scope notes. The cross-reference system of *CABT* includes USE, UF, BT, NT and RT, by which forms of terms, meanings of terms, and inter-term relationships can be effectively controlled. Besides the above-mentioned five kinds of cross-references, *CABT* (1st ed. & 2nd ed.) also uses OR cross-references for individual cases.

F.W. Lancaster has proposed that a thesaurus can be evaluated by some existing standards, namely connectedness ratio, accessibility measure and equivalence ratio.

The connectedness ratio is the ratio of cross-referenced terms (i.e., terms linked to at least one other term; e.g., by BT, NT, or RT) to total terms in a thesaurus. In other words, the fewer non-cross-referenced terms a thesaurus includes, the higher the connectedness ratio will be, and the better structure the thesaurus will have. According to statistics from a test performed by taking a random sample of *CABT*, there are only

four non-cross-referenced terms in 120 pages of *CABT* (10% of the length of *CABT*, 1st ed.), there are 4,855 terms in these sample pages. So the connectedness ratio of *CABT* is 0.999.

The accessibility measure is the mean number of references received by a descriptor in a thesaurus. The more each term in a thesaurus is referred to other terms, the higher the accessibility measure. This can indicate whether an inter-term relationship in the thesaurus is sufficiently displayed. According to the sampling statistics, the accessibility measure of *CABT* is 5.78, in which the BT-NT accessibility measure is 4.78, and the RT accessibility measure is 1.08.

The equivalence ratio is the ratio of nondescriptors to descriptors in a thesaurus. It relates to the number of nondescriptors in the thesaurus. In the first edition of *CABT*, the number of nondescriptors is 7,200, and the number of descriptors is 40,800, so the equivalence ratio of the first edition is about 0.18. In the second edition, the number of nondescriptors is 8,600, and the number of descriptors is 47,400, as a result the equivalence ratio of the second edition is also 0.18, the same as the first edition. A comparison between *CABT* and several other authoritative thesauri in the world is shown in Table 1.

Name of Thesaurus	Connectedness Ratio	Accessibility Measure	Equivalence Ratio
MeSH (1976 ed.)	0.573	0.381	0.5*
LCSH (7th ed.)	0.799	1.032	0.22*
ASTIA (2nd ed.)	0.956	1.492	-
TEST (1st ed.)	-	2.903	0.31*
CABT (1st ed.)	0.999	5.860	0.18

Table 1. The comparison between *CABT* and several other authoritative thesauri

(The data marked with an asterisk are obtained from the statistics of *Thesaurus Guide*, the data for *CABT* (1st ed.) are based on the sampling statistics and the rest are cited from *Vocabulary Control for Information Retrieval* (Lancaster, 1972).

From Table 1, it can be seen that the connectedness ratio and accessibility measure of *CABT* are both the highest among all the thesauri listed above, which indicates that *CABT* is superior to the other thesauri in the display of inter-term relationships and is therefore of better adaptability. As for the accessibility measure, it is generally considered that the ideal value should range from 2 to 5. As the result of displaying all the hierarchical relationships in *CABT*, the BT-NT accessibility measure amounts to 4.78 and the RT accessibility measure reaches only 1.08. However, the accessibility measure is adequate in general. The equivalence ratio of *CABT* is far less than those of the several other thesauri mentioned above and less than the average of large thesauri (i.e., 0.62) in the 1980s as well. This shows that the number of nondescriptors included in

CABT is not sufficient, which probably relates to the fact that there are few USE cross-references in the subject index of CAB ABSTRACTS. In view of the above-mentioned fact, some synonyms and quasisynonyms, which appear frequently in documents and/or are possibly used by users, should be added to *CABT*. In addition, some excessive specific terms can be replaced by their superordinate terms and then set up USE cross-references between these subordinate terms and superordinate terms. In a word, more entry terms should be added to *CABT* to facilitate indexing and retrieving.

In the areas of collection and selection of terms, vocabulary control, symbols of cross-references, display of terms and their relationships, *CABT* basically follows ISO 2788 (i.e., *Documentation-Guidelines for the Establishment and Development of Monolingual Thesauri*), there are obviously two problems as follows:

1) Treatment of the hierarchical relationships. ISO 2788-1986 stipulates that only those terms with the generic relationship and whole-part relationship which covers a limited range of situations can be organized as a hierarchy.

The structure of *CABT* does not strictly follow this rule. Almost all the terms with a hierarchical whole-part relationship are organized as a hierarchy; even those terms with the whole-aspect relationship or with an associative relationship are related hierarchically. Here are some typical examples:

```

Blood
  BT1  body fluids
  BT2  animal anatomy
  BT2  fluids
  NT1  blood cells
  NT2  erythrocytes
  ...  ...
  NT1  blood composition
  NT2  blood chemistry
  NT3  blood lipids
  NT3  blood sugars
  NT2  blood proteins
  RT   blood proteins
  RT   blood sugars

```

According to ISO 2788, in a whole-part relationship, it is only 1. body and organs, 2. geographical location, 3. administration and social community, and 4. branches of disciplines that we can use to establish BT/NT cross-references as hierarchical relationships. But it is apparently contradictory to regard the descriptors "blood cells," "blood proteins" and "blood sugars" which have a whole-part relation with the term "blood" as related descriptors (RT) and as narrower descriptors (NT) of "blood" at the same time. Facing this kind of processing method, which you can find everywhere in *CABT*, we wonder why the editors regard the same descriptor as NT as well as RT. In addition, it is also not appropriate to set up BT/NT references for non-hierarchical terms "animal

anatomy" and "blood," "blood" and "blood composition," "blood composition" and "blood chemistry." So, the establishment of such disordered relationships, which you can find throughout the thesaurus makes users feel that it is much more difficult to access.

2) In distinguishing popular names and scientific names, ISO 2788-1986 specifies that if a popular and a scientific name refer to same concept, the form most likely to be sought by the users of the index should be chosen. For example "penguins" might be chosen as the preferred term in a general index, but the scientific equivalent, "Sphenisciforms," may be preferred in a zoological index. Reciprocal entries should be made in these cases. The standard also requires that USE/UF references should be established for the two terms. But, for *CABT* it's difficult to solve the problem, for instance, "Field Crops Abstract" often uses popular names to represent "crops," whereas "Plant Breeding Abstract" usually chooses scientific names. In order to avoid disorders, *CABT* provides double-nomination for some kinds of plants which use both popular and scientific names as descriptors, while a RT reference is set up between them. For example, following are the two entries "Zea Mays" and "Maize" for the concept "Maize" in *CABT* (1st ed.).

Zea Mays	Maize
uf corn*	uf corn*
bt1 cereals*	bt1 cereals*
bt1 crop plants as weed	bt1 silage plants
bt1 fodder crops*	bt2 fodder crops*
bt1 oil plants	nt1 dent maize
bt1 Zea	nt1 flint maize
bt2 gramineae	nt1 soft maize
rt alcoholic beverage*	nt1 sweetcorn
rt breakfast cereals*	
rt flint maize	rt alcoholic beverage*
rt maize*	rt breakfast cereals*
rt maize chlorotic dwarf	rt cornflour
virus	rt maize*
rt maize dwarf mosaic virus	rt maize oil
... ..	rt maize starch
rt popcorn*	rt popcorn*
rt starch	
rt sweetcorn	rt Zea Mays
rt tassels	

In these two entries, "Zea Mays" and "Maize" contain 23 and 47 cross-references respectively. Among them seven of the uf, bt and rt entries are the same, the others are quite different, even contradictory. In addition, the popular name contains some nts while there are not any under the scientific name at all. Some nts such as "flint maize," and "sweet corn" are even put in the rt reference area. Sometimes the referred word's form is different when two entries for descriptors are directed to the same concept when

setting up references. For example, when referred to "starch," one entry is directed to "starch," the another to "Maize Starch." You can find similar results in the survey of four main crops expressed by eight terms in Table 2, which was examined by the authors.

	UF		BT			NT			RT			
	Tot	Sam	Tot	Sam	Dif	Tot	Sam	Dif	Tot	Sam	Sim	Dif
Maize	1	1	3	2	1	8	0	8	35	4	1	30
Zea Mays	1	1	6	2	4	0	0	0	16	4	1	11
Rice	1	1	1	1	0	5	0	5	11	1	2	8
Oryza Sativa	1	1	5	1	4	0	0	0	16	1	2	13
Wheat	0	0	1	1	0	4	0	4	16	0	1	15
Triticum Aestivum	0	0	4	1	3	0	0	0	8	0	1	7
Cotton	0	0	5	1	4	0	0	0	16	0	0	16
Gossypium Hirsutum	0	0	4	1	3	0	0	0	1	0	0	0

	Sum		
	Total	Same	Different
Maize	47	7	40
Zea Mays	23	7	16
Rice	18	3	15
Oryza Sativa	22	3	19
Wheat	21	1	20
Triticum Aestivum	12	1	11
Cotton	21	1	20
Gossypium Hirsutum	5	1	4

Table 2. Comparison of entries of scientific name with common name in CABT.

From Table 2, we can see that the process of making separate entries for descriptors under scientific name and popular name of plants and animals artificially cuts apart the related linkage and destroys the integration and consistency in cross references. As a result, some of the cross references are repetitive, and some are not enough, nts are put together under the popular names, whereas rts are collected under the scientific names. It is suggested that the method of selecting "the form most likely to be sought by users" (usually popular names), collecting all references under the popular names and making USE/uf links between the popular names and the scientific names should be used. This method can make references under the descriptors a complete, unified organization, avoid differences from beginning to end, reduce errors and make it easy for users to select what they want to look up. It would also make the abstracts journals which must choose scientific names easier to use.

Although there are some defects, *CABT* is still a thesaurus of great impact, with the most users and the most influence in the world of agriculture. It is hoped that after further improvements, the next edition of *CABT* will become the most commonly used indexing language in agricultural information work.

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Realization and Application of Large Capacity Chinese Character Disk Operating System (LCCDOS)

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Abstract

The development of LCCDOS and the Chinese word processing software, Chinese WordStar (CWS) that is supported by LCCDOS are discussed based on an analysis of how to enable the microcomputer disk operating system (DOS) to process data in the Chinese language.

Preface

At present, the Chinese Character DOS (CCDOS) for use in microcomputers only supports more than seven thousand Chinese characters and other characters. Because the internal code of CCDOS is composed of two bytes, Chinese characters are expressed by the highest bit set, the maximum number of Chinese characters and other characters that can be expressed is more than 17,000 besides the Chinese character mark bit and the control characters. For Chinese information processing, particularly in comprehensively managing agricultural information resources, this number of Chinese characters is not sufficient. So, Large-capacity Chinese Character Disk Operating System (LCCDOS) has been developed by the Sciencetech Documentation and Information Centre, Chinese Academy of Agricultural Sciences. It can support 30,000 Chinese characters as well as other characters. At the same time, the function of the word processing software Chinese WordStar (CWS) has been expanded in order to have it supported by LCCDOS.

I. DOS Sinicizing Analysis

CCDOS for use in microcomputers is developed based on the Western language MS-DOS. The aim of sinicizing is to enable DOS to process both the Western languages and Chinese language at the same time. In order to achieve this aim, the main problems that must be solved are Chinese character expression and storage in a computer, their input and output, etc. In brief, we have done the following based on DOS:

1. Expression of Chinese characters in computers. Chinese character designation adopts a two-byte Chinese character internal code. A Chinese character is expressed by the highest bit of a two-byte set. This kind of Chinese character internal code can express about 9,000 Chinese characters and other characters.

2. Image storage of Chinese characters. Since the Chinese character image is needed when displaying or printing Chinese characters, the image information of each Chinese character must be provided. CCDOS adopts the dot matrix method to store the Chinese character image information, and all dot matrixes of Chinese characters are put in one file forming the Chinese character library for use in displaying and printing.

3. Input of Chinese characters. The small keyboard is designed for Western language input and there are no Chinese characters on it. In order to input Chinese characters on a small keyboard, we have designed several input methods in CCDOS, such as zone bit and phonetic transcription, etc. When a Chinese character has been inputted in one method, we can change the input code into an internal code through a corresponding table or algorithm.

4. Display of Chinese characters. For displaying the Chinese characters, the display processing program has been modified and expanded in CCDOS based on the Western DOS. On one hand, the character display format has been changed into an image format. On the other hand, the identifying and processing of the Chinese character internal code have been added. We have adopted the method of reading out the dot matrix from the Chinese character library and then putting it into the screen refresh area to display the Chinese characters.

5. Printing of Chinese characters. For printing the Chinese characters, some modification and expansion of the original print program have been done in CCDOS. The main task was to add the identifying Chinese character internal code and the link to the appropriate Chinese character library.

II. Selection of Schemes for Expanding Chinese Character Processing Capacity

The following three main problems exist in expanding the Chinese character processing capacity:

1. Internal codes.

From the above analysis we know that a key problem of expanding our capacity to process Chinese characters is the selection of the Chinese character internal code. From the viewpoint of expansion, the following are three feasible schemes in the selection of the internal code:

1) Two-byte internal code. For the first byte, the highest bit is set. For the second byte, there are no restrictions on the highest bit.

2) Three-byte internal code.

3) Internal code of combining two bytes with three bytes. The basic Chinese character set uses a two-byte internal code. The expanded Chinese character set adopts a three-byte internal code.

The first method has the following advantages: the shortest internal code, storage consistent with display and the Chinese language can be compatible with the Western language in processing. But the number of Chinese characters can only be expanded to about 17 thousand because of the limit to the length of the internal code. This can't meet our requirements, so we can only select one of the last two schemes. The third method is more complex than the second in processing, but the third one maintains a compatibility between LCCDOS and CCDOS. So we have selected the third one.

2. Organization and storage of the Chinese character library (CCLIB)

If all Chinese characters could be coded onto a computer card or stored in external or expanded memory which is beyond the 640k limit of internal memory, this problem would not exist. But at present, we can not attain either of these, so we must seek other alternatives to solve this problem.

For the organization of the CCLIB, there are two schemes, that is, the single CCLIB and multiple CCLIBs. We selected the latter. Besides the basic CCLIB, we have added three expanded CCLIBs whose size is the same as the basic CCLIB.

The basic CCLIB is stored in the internal storage area and the other three expanded CCLIBs are stored in the external storage area, that is all expanded Chinese characters are stored on a hard disk.

3. Input of Chinese characters.

Although all types of input in the original CCDOS can be used in LCCDOS directly, they are only suitable to inputting basic Chinese characters. In order to solve the problem of inputting expanded Chinese characters, we use the following two ways:

1) Modifying the existing zone bit input to adapt inputting the expanded Chinese characters. The key point of this is to expand the expression scope of the zone bit code. We can build a corresponding relationship between each expanded zone bit code and each expanded Chinese character.

2) Designing one or more new kinds of input. All these new input methods can use existing input principles. The main task to be done is to design the input codes for the expanded Chinese characters based on the coding regulations, and build the correspondence table between input code and internal code.

We have adopted the first way mentioned above in LCCDOS, so only the zone bit input method can be used to input the expanded Chinese characters in LCCDOS at present.

III. Realization of LCCDOS

LCCDOS is developed by modifying the original CCDOS. There are the following principal aspects that have been modified:

1. **Internal codes.** CCDOS adopts two-byte internal codes, but LCCDOS uses an internal code combining two bytes with three bytes. LCCDOS adopts a two-byte internal code for basic Chinese characters following that of CCDOS. So this can keep LCCDOS compatible with CCDOS. The expanded Chinese characters use a three-byte internal code, of which the first byte is the mark byte, the last two bytes have the same value range as the basic Chinese character internal codes. The mark byte is used to mark the Chinese character library to which the Chinese characters belong. Its value range is hexadecimal FC to FE, which represent the three expanded CCLIBs, that is, if the value of the mark byte of a Chinese character internal code is FC, then this Chinese character belongs to the first CCLIB, and so on.

2. **Keyboard entry.** Since the first CCLIB of LCCDOS is the same as the CCLIB of CCDOS, and the internal code of this part of the Chinese characters doesn't change, LCCDOS can use any kind of CCDOS input to input the basic Chinese characters. But with the expanded Chinese characters, the original input ways don't work. In order to input the expanded Chinese characters, the original zone bit input method has been modified in LCCDOS. A zone bit code is expressed by four hexadecimal numbers instead of by four decimal numbers in the former. The maximum value of the zone bit code is changed into 255 instead of 94. The total number of Chinese characters and other characters that the zone bit code can express is 65,025. The range of corresponding zone bit codes of each CCLIB is:

The first CCLIB: 0101-5B5E
The second CCLIB: 015F-5BBC
The third CCLIB: 5F01-B95E
The fourth CCLIB: 5F5F-B9BC

After a Chinese character has been input by zone bit code, the basic Chinese characters and the expanded Chinese characters are processed separately. The basic Chinese characters are directly transformed into internal codes, the internal code count is 2. The mark bytes of expanded Chinese characters are added in the course of input processing, the internal code count is 3.

3. **Screen display.** In LCCDOS, we have added some judgments and processing for the three-byte internal codes. For the two-byte internal codes, we also use the same processing as CCDOS, that is to calculate the segment address in the internal memory of its dot matrix according to the internal code and then read the dot matrix of the Chinese character and display it. For the three-byte internal codes, we must calculate the storage sector of the corresponding dot matrix of the Chinese character in the hard disk according to the internal code, then read the data of the sector into internal memory using interrupt X'13', and finally fetch the dot matrix from memory. The other processing is the same as that of CCDOS.

4. **Printout.** The judgments and processing for the three-byte internal code have also been added. It is modified to be similar to that of screen displays.

Some application software supported by CCDOS would have a problem if they were operated under LCCDOS. For example, there will be a space before every expanded Chinese character when it is displayed on screen. This problem can be solved by modifying the application software.

IV. Establishment of CCLIB in LCCDOS

In order to build the CCLIBs for LCCDOS, we have developed a character-constructing software package. Besides the functions which common character-constructing software possesses, this software has its own characteristics:

1. The expression and range of zone bit code are different from common character-constructing software. The zone number and bit number are both expressed by hexadecimal numbers, whose maximum value is 255, not 94.
2. The fetch CCLIB and the store CCLIB are separated. The common character-constructing software only relates to one CCLIB, but this software relates to two CCLIBs; one is the fetch CCLIB specifically for fetching Chinese characters, the other is the store CCLIB specifically for storing the Chinese character that has been made. These two CCLIBs can be the same one.

The structure of the four CCLIBs is same, so the expanded CCLIBs can use the structure of the basic CCLIB. When we build the expanded CCLIBs, first we can copy a basic CCLIB, then each Chinese character in the duplicated CCLIB will be modified, so we can get a new CCLIB.

Because we modify the basic CCLIB to build the expanded CCLIBs, it is not necessary to build the Chinese characters in the order of the zone bit code and complete it at one time. We can complete it step by step.

V. Application of LCCDOS

In the realistic application of LCCDOS, it is necessary to modify the software which is supported by CCDOS. We have modified the software CWS which now has more comprehensive functions and wide applications.

From the above analysis we know that if the software supported by CCDOS is operated in LCCDOS, there will be a space before the expanded Chinese characters are displayed on screen. This space is caused by the mark byte of the expanded Chinese character internal code. This problem will affect our editing work. So we must solve it.

First of all, let's look at the CWS program. In these programs there are two buffers, one is the screen buffer, the other is the line buffer. The length of a line in both buffers is 80 bytes. Because the three-byte internal codes are introduced, the number of Chinese characters that can be displayed in a line will be reduced. From the point of eliminating the spaces before the expanded Chinese characters on screen and keeping the number

of Chinese characters displayed in a line unchanged, we think there are the following two modifying schemes:

1) Expanding the line buffer and the screen buffer to enable a line to put forty three-byte Chinese character internal codes, that is, the length of the line of the buffer is enlarged to 120 bytes from 80 bytes. When the contents of the line buffer are displayed, the place of the cursor must be controlled to ensure that each expanded Chinese character only takes up two rows on a screen.

2) Keeping the size of the line buffer and the screen buffer unchanged and trying to have the mark byte of the three-byte internal code stored in another place. That is, we establish another two buffers to hold the mark bytes of the expanded Chinese characters, and don't let them enter the line buffer and the screen buffer.

After analysis and comparison, we adopted the second scheme. In the course of processing, the mark byte is put into the mark buffer instead of the line buffer and the screen buffer. Only the last two bytes are put into the line buffer and the screen buffer. When the contents of the line buffer are displayed, the Chinese characters must be defined by a combination of the contents of the line buffer and the contents of the mark buffer. But the placement of the cursor is only based on the contents of the line buffer. For other software, the method of modification is the same as this one on the whole.

Summary

The successful development of LCCDOS not only enables the use of computers to manage agricultural information resources, but also provides possible conditions for the large information centers in using the computer systems. This LCCDOS can support thirty thousand Chinese characters and other characters. It can be expanded to support sixty thousand Chinese characters and other characters by using the same principle.

The Close Associations between Indexing and Microcomputer Software Maintenance

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Abstract

The close associations between document pre-processing and microcomputer software maintenance are studied based on the experience of setting up the Comprehensive Database of Chinese Agricultural Bibliographies using microcomputers. The suggestion to combine indexing with inputting to exploit the potential of applied software and the feedback of the suggestion of doing the indexing and data input simultaneously is made. It is necessary to develop application software which has a definite objective in view and to study the effects of indexing quality on information retrieval. The author of this paper also suggests that training a contingent of qualified T-type personnel is very important for assuring the set up of a database.

In recent years, the vast amount of scientific and technical documents increasing dramatically all over the world along with the full speed development of modern science and technology has resulted in more and more barriers for users to search books and reference materials.

Information retrieval is the guide book by which readers gain access to a huge treasure house of information, and searching by computer is rapid and effective. One necessary condition for using computers to do information retrieval, however, is to first set up a database of sufficient size. For this purpose, a lot of work in both the pre-processing (including the selection of subject material, registration and indexing) and the microcomputer operation (such as selecting suitable software, building up a set of file specifications required for building a database applying this software, inputting the pre-processed data, and debugging and maintaining the software) would be done. The objectives of this paper are to study the close relationships, inter-permeated and inter-stimulated, between the pre-processing of the data and software maintenance based on the experience of setting up the Comprehensive Database of Chinese Agricultural Bibliographies using a microcomputer.

SIMULTANEOUS INDEXING AND INPUT TO INCREASE EFFICIENCY AND DATABASE QUALITY

At the beginning of 1989, we (N.E. Sub-centre) took part in the project to set up the microcomputer-based database, sponsored by the Information Centre of CAAS. Generally, doing this work would demand several staff who would be in charge of

indexing, software maintenance and inputting data, respectively. In our experience, however, we found that data input and indexing can be done simultaneously. By doing so, the efficiency would be increased and the quality of the database would be improved and a lot of paper would be saved.

At first, we used to fill in the items on the worksheet one by one. Every record must be filled in on a worksheet (16 cm sides). Later, because the indexing and inputting processes had to be completed by the same person, these indexing items were only filled in on the worksheet and the descriptive elements could be omitted. The temporary numbers were inputted into the computer but the assigned one-up serial numbers of the titles were indexed, so the final serial number would exactly match the total number of records for a serial by the end of indexing, which made it very convenient to count up the total titles of each serial issue. The following fields were directly inputted for each title:

Type of Document, Language, Author, Other Authors, Title of Serial or Book, Sponsor or Author, Publication Year-Volume-Issue, Annotation, and so on. Therefore the pre-processing efficiency could be raised by about 40%.

A new technique for automatically forming indexing entries by using nine functional symbols, was developed in Sept. 1989 by Wang Huaihui working in the Information Centre of CAAS. This advanced method has improved the building of the database. The efficiencies of indexing and inputting were raised by 35% more or less, and indexing was more simple when using these functional symbols. Merging the two steps of indexing and inputting into one not only has high efficiency but has also improved the quality of work. This also allows indexing mistakes to be conveniently corrected at the time of input. For example, we may think we have a paper concerned with sheep diseases when the Class Number is input as S858.26, but if we then find out it has been assigned a Subject Term for swine disease, at that point we could change the Class Number "S858.26" to "S858.28" immediately. Under normal circumstances, the workers are vigorous and sober-minded when the contents of the worksheets are being input one by one into the computer, and then having the satisfaction of seeing one's final results is possible. On the other hand, if the process of indexing and inputting is preformed by two different persons, ideal effects could not be obtained. In addition, the special input staff often do not understand the indexing process and the indexing staff usually takes much time as they proofread the final proofs, so some mistakes and waste of manpower might be occurring.

DEVELOPMENT OF APPLIED SOFTWARE BASED ON THE NEEDS FOR CREATING A DATABASE

The application software commonly used for setting up databases is Micro CDS/ISIS, the operating system is CCS3.3L-LX Chinese Card. Since this operating system is dependent on phonetic association, the inputting speed might be influenced without the good Five-Stroke Structure System. Although two steps of indexing and input merged into one step could have raised the efficiency and quality of setting up the

database, the input process would fall into the same plight again without a good operating system. Therefore we have tried to run Micro CDS/ISIS under the Five-Stroke Structure System and we have been successful. In this case, the functions of browsing, printing and searching could be run successfully except for the following two shortcomings: 1. The first menu of the database might disappear too soon; 2. Some names of fields on the work sheet could not be displayed. But both these deficiencies are no problem to a skilled person. In order to help the novice, first, we printed the first level menu of the Micro CDS/ISIS system under the CCS3.3L operating system as the supplementary screen menu; second, the names of fields that did not display on screen could be found from the work sheet. As stated above, after practicing again and again, the new hand could work skillfully. According to our experience, after matching the Five-Stroke Structure System with Micro CDS/ISIS software, input speed has been increased by five times. Over 300 records could be inputted within two work-days each month. The speed would be more rapid if operated by a special staff.

CONDUCTING AN INFORMATION SEARCHING TEST TO MODIFY INDEXING MISTAKES

The information searching test has not only served the readers but is also a means through which the data of an information database could be modified, coordinated and united.

At the core of indexing work is subject analysis, but usually, the results of subject analysis vary with the person and work time. This kind of case frequently crops up, especially because we lack a normal thesaurus at the present time. So the terms selected from the Free Word field could be divided into Normal and Abnormal Free Words. The so-called Normal Free Words are those words indexed according to the Chinese Thesaurus, the Agriculture Thesaurus and other special handbooks; and the so-called Abnormal Free Words are truly just free text words. In these cases, the indexing errors made by a single operational person would be uncountable in spite of the errors made by several operational persons. So it seems that the key is how to minimize individual errors over time to maximize the consistency of indexing. The method we took to solve this was to conduct the information searching tests frequently and definitively to decrease indexing mistakes and improve the quality of indexing.

Example 1. Normally, "Chickens Marek's Disease" was regarded as a pre-coordinated term. In order to check whether this word was treated in this form in all records after indexing over 800 records, a Boolean search was conducted and the searching formula is "Chickens * Marek's Disease." The results showed that in record no. 298 it was treated as a post-coordinated word, and then it was modified immediately.

Example 2. In addition, the rapid inquiry would be conducted to determine if some words were regarded as Use term (U) or replaced by Used for combination (UFC). For instance, Vaccine inoculation is generally treated as a UFC and Immunity Inoculation as the Use term. Four wrong records were discovered this way and then modified at once.

Example 3. Artificial Insemination of Domestic Animal usually belongs under the category of Reproduction in the light of China's National Classification Scheme for Books (CNCSB) but according to the AGRIS Classification Scheme, this descriptor belongs under the category of Animal Genetics and Breeding with a class number L10, and the latter classification only possesses Animal Physiology Reproduction with class number L53 other than the broader term of Reproduction. On the basis of CCB principles, all Artificial Insemination of Domestic Animal records were distributed into the class mark of L53. To check them, the search strategy (Artificial Insemination + Freezing Semen) * L53, was formed, and then six incorrect records were discovered, and subsequently changed their Subject Category Code of L53 into L10.

Example 4. Crop Tissue Culture was distributed in the category of Genetics Breeding in CNCSB, but it was located in the category of Plant Reproduction based on the AGRIS Classification Scheme with class number F02. In order to identify those records which were mixed in Plant Genetic and Breeding (class number F30) concerning tissue culture, the search strategy (Tissue Culture + Embryo Culture + Shoot Tip Culture + in Vitro Culture) * F30, was executed. Four incorrect records were then discovered and as a result, the F30 (Subject Category Code) was changed into F02.

In the light of our indexing experience, it seems that those Abnormal Free Words would be united whenever possible to avoid the repetition of synonymous words. This task still would be dependent on executing searches to detect incorrect records. All of the following words were classified as bound forms in this way, e.g., Grain Water Content, Grain Yield, etc. If they need to be modified in the future, these words would be changed into bound forms in the same way also.

It is very difficult to discover inconsistencies in indexing in records based on their serial number. In this case, inconsistencies in indexing within the same concept or category, could be apparent when the united searching and browsing had been conducted on special terms or categories, e.g., descriptor sequence, indexing depth, selection of heading word, and the Subject Index Entry. After indexing of a set of records had been completed, each record in a category would be searched and browsed. All problems (mistakes) displayed on the screen were written down and modified uniformly one by one. For convenience and consistency of indexing, the Free Word List was printed according to the inquirer, who checked the occurrence frequency of the words, compared them, and then decided which terms to choose.

THE RELATIONSHIP BETWEEN TRAINING QUALIFIED T-TYPE PERSONNEL AND BUILDING THE COMPREHENSIVE BIBLIOGRAPHIC DATABASE

The comprehensive database covers over twenty new subjects of agricultural sciences as well as its related fields, and nearly twenty types of documents. In fact, the database not only serves for automated searching of information, but also the publishing of reference books for manual searching. There are 32 fields for each record, eleven of

them being searchable fields. The reasonable structure of this database is designed with a great number of access points which are well-organized.

It requires a large amount of manpower to build the database. If we have enough people who are qualified, we can do the work of selection of subjects, description, indexing, input and software maintenance in assembly line fashion. That is, a specific person is assigned to each step of the work mentioned above, and it is coordinated by one person. Our sub-centre, however, is short of staff (only 2-3 workers) and we process our data independently under the unified command by the National Centre. So we can not set up an assembly line because we lack staff and we only have two persons, specifically, one person is in charge of indexing (including selecting the subject and registration) and another is in charge of inputting and software maintenance. One consequence is lower work efficiency, and some mistakes in linking occur which could influence the whole process of setting up the database. According to the actual schedule of every sub-centre, work procedures vary widely. Some sub-centre might be short of staff for software maintenance, so that data have not been inputted into the database in a timely manner, while another sub-centre might be short of indexers and the software experts are helpless. In view of the above mentioned facts, we would like to make the proposal that an excellent T-type qualified personnel contingent must be built up as soon as possible, so that 2-4 persons in each sub-centre could independently successfully operate the database by themselves. If this were the case, the process of setting up the database could be sure to run without a hitch, even though some persons may happen to leave. The other advantage of working independently is that people can keep informed on how the setting up of the database is progressing, and can grasp and solve the problems taking place in each link to improve the quality of the database.

In short, the various links are organically combined as well as dependent on each other during the whole course of setting up the database, and then it is very important to keep this close relationship, inter-permeated and inter-stimulated, between indexing and maintenance of microcomputer software. This paper sums up the preliminary experience of two years of practice, and undoubtedly many techniques will be discussed further on down the road.

Program for Automatic Creation of Subject Indexes by Computer

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Abstract

There are subject indexes for most of the reference books in China. But all the indexes are edited and sorted manually. The database software of CDS/ISIS for microcomputer doesn't have a computer-assisted indexing capability. We have developed software which uses nine indexing function symbols to aid in automatically creating indexes on a microcomputer. We have developed a computer-assisted indexing system which enables the index entries to be formed automatically and edits the indexes. It can control the logical relationship among descriptors and the layout of access points through indexing function symbols. Manual intervention is not needed. The work efficiency has been enhanced and the quality of publications improved by using the indexing system.

1. Subject Indexes of Chinese Agricultural Information Materials

Indexes of documentation sources in various subjects are inevitable tools for research and study. Since the 1980s, we have gradually added subject indexes to most of the Chinese reference materials. Those indexes are mainly edited, classified, arranged and printed by traditional methods. Following wide use of computer technology, the Chinese subject indexes can be edited partially by computers. Librarians choose and decide entries for the subject index, and use a computer to arrange its order by vocabulary and compose the printed form. By doing so, it has saved much labor, standardized documentation indexing rules and enhanced efficiency and quality.

There are two types of subject indexes for agricultural materials: computer-formed and pre-computer-formed subject indexes. The advantages of the former type are simple arrangement, less artificial results, and the small size of the index body. The disadvantage to the concept is its limited description of subjects. The advantages and disadvantages of the latter type are opposite of the former. This type of subject index raises higher requirements for index editors for its huge amount of indexing. However, computers may help them to automatically produce subject indexes with accurate subject concepts. There are special and distributed modes in the pre-permuted-formed type of subject indexes. We use descriptive words in which we put a hyphen between words and change the hyphen to a blank when printing.

2. Subject Index Edited by Computers

The computer assisted subject index is a combination of both humans and the computer edited subject index system. It requires the indexing librarian to use the nine tags of the system to do the indexing first, then, computer technicians will input the data into the bibliographic database of agricultural documentation. The database includes 33 fields. The subject index terms are in the subject field of the database. The system automatically erases the functional tags of indexing and sends subject terms to the field as well as to the subject index. Because of this automatic production of subject index and subject terms, it can greatly decrease the indexing librarians' work load, avoid duplication and make the subject terms and indexes more standard.

(1) Function Tags Automatically Given in Subject Index Field

The function tags include: ; ! ? @ = - \) *. These tags are inserted following each key word.

Meaning of the function tags:

1. ; (**semicolon**) The key word in front of a semicolon means that it is the auto-given guiding term of a paper of the subject index entry. In each subject index entry, the guiding word must be in the title or sub-heading of the paper. This kind of key word is called a semicolon key word.

2. ! (**exclamation mark**) The key word followed by an exclamation mark is not a guiding term, however, it can be used in rotation with a semicolon key word to form two index entries. When it is put in front of the semicolon key word, it becomes the main heading. When it is put after the semicolon key word, it becomes the secondary subject term.

Example: Prawn Breeding and Market

key words and function tags: prawn; breeding! market!

subject terms: prawn
breeding
market

subject index entry: prawn - breeding
prawn - market
breeding - prawn
market - prawn

3. ? (**Question Mark**) The key word before ? is a restrictive term which can only be used as a component part of the semicolon key word. It can not be rotated with other words and must always be put after the semicolon key word for limitation. It also can be used as a subject heading, i.e., the secondary subject. Such key words are called question mark key words.

Example: Survey of Extrinsic Agriculture in Shenzhen

key words and function tags: extrinsic agriculture; Shenzhen! survey?

subject terms: extrinsic agriculture
 Shenzhen
 survey
 subject index entry: extrinsic agriculture - Shenzhen
 Shenzhen - extrinsic agriculture
 extrinsic agriculture - survey

From the example, we can see that the question mark term "survey" may only limit the semicolon key word "extrinsic agriculture," it cannot be a component part of the exclamation mark key word "Shenzhen" and rotated with other words.

4. **@ (Copyright Mark)** The key word before the copyright mark should be put in front of the semicolon key word only. As a main subject heading, it can not be put after any key word or rotated. This key word is the copyright key word.

Example: Development Precautions of developing agriculture in Mountain Areas
 key word and function tags: developing agriculture; mountain areas! development
 precaution? agriculture@
 key words: developing agriculture
 mountain areas
 development precaution
 agriculture
 subject index entry: developing agriculture -mountain areas
 mountain areas - developing agriculture
 developing agriculture development precaution
 agriculture - developing agriculture

5. **= (Equal Sign)** The key word after the equal sign is a part or description of the key word before the equal sign. The equal sign key word can not be rotated. However, when the question mark together with the key words before and after it appear as one series, it can organize a compound semicolon key word, compound exclamation key word, compound question mark key word and compound copyright key word. It may form the triple and fourth level subject term.

Example: An Announcement of the Ministry of Agriculture on Methods of Economic Auditing of Village and Town Factories
 key words and function tags: Ministry of Agriculture = announcement;
 village and town factory = economy!
 audit = method?
 subject terms: Ministry of Agriculture
 announcement
 village and town factory
 economy
 audit
 method

subject index entry:

Ministry of Agriculture - announcement - village and town factory - economy
 village and town factory - economy - Ministry of Agriculture - announcement
 Ministry of Agriculture - announcement - audit - method

The compound key word's functions are determined by the function tag following it.

6. - **(Dash)** This tag means that the key word after it is a part or description of the key word before it. Its functions are basically the same as the equal sign key word. The difference is that the key words following dash are normally common key words used to form a subject index entry. Within subject fields, the key words following the dash may be not kept.

Example: History, Present Status and Outlook of Research in Ecological Agriculture

key words and function tags: Ecological agriculture;
 agricultural history!
 research - present status - outlook?

subjects: ecological agriculture
 agricultural history
 research

subject index entry: ecological agriculture - agricultural history
 agricultural history - ecological agriculture
 ecological agriculture - research - present status -
 outlook

"present status" and "outlook" are common words which are not kept in the subject term field.

7. \ **(Converse Slant)** Converse slant means that the word it follows is an independent word representing the full concept of a paper. There is no need for it to be combined with other words.

Example: Cattle Rearing

key words and function tag: cattle rearing \

subject: cattle rearing

subject index entry: cattle rearing

A converse slant key word is one full meaning word which can be combined with equal sign key words and dash key words to form compound key words.

8.) **(Half Bracket)** When one paper contains multiple subject concepts, we use a half bracket as a separation mark to avoid false composition and confusion of concepts.

Example: Research of Radiative and Stable Isotope Tracer P^{32} ; Behavior and End-result of Roundup in Soils and Mechanism as well as its influence of phosphorylase isoenzyme on rice and wheat.

key words and function tags: roundup = behavior = endresult;
 soil!) phosphorylase isoenzyme;
 rice! wheat!) P^{32} ;
 isotope = stability = radioaction! herbicide -
 metabolism!) chemical herbicide;
 mieshengxing! weed = physiology!)*

subject terms: roundup
 behavior
 endresult
 soil
 phosphorylase isoenzyme
 rice
 wheat
 P^{32}
 isotope
 stability
 radioaction
 herbicide
 chemical herbicide
 mieshengxing
 weed physiology

subject index entry: roundup - behavior - endresult - soil
 soil - roundup - behavior - endresult
 phosphorylase isoenzyme - rice
 phosphorylase isoenzyme - wheat
 rice - phosphorylase isoenzyme
 wheat - phosphorylase isoenzyme
 P^{32} - isotope - stability - radioaction
 isotope - stability - radioaction - P^{32}
 P^{32} - herbicide - metabolism
 herbicide - metabolism - P^{32}
 chemical herbicide - mieshengxing
 mieshengxing - chemical herbicide
 chemical herbicide - weed - physiology
 weed - physiology - chemical herbicide

9. * (asterisk) The asterisk and the half bracket can be used in coordination. In processing papers with multiple subjects, we add the asterisk following the last separation mark (half bracket) to show the end of the multiple subjects (see example above).

(2) Technical Problems in Auto Forming an Index Entry

The bibliographic database of agricultural documentation was set up by using CDS/ISIS software which was transformed into Chinese. For dealing with problems of duplication in indexing and inputting of subject terms, we programmed to produce the subject index entry in two ways:

a) Use an advanced programming language to write a program for data file management. Input the bibliographic data for the agricultural documentation database into the file management system together with the key words and function tags corresponding to fields for auto-assigned subject terms and subject index entries, then, store each record in sequence in ISO 2709 format and through the transforming controller of ISO 2709 send the data to the main database. In this way, we may input all data into the main database in one transforming process. However, there is still a problem when technicians input data because of the lack of a full screen display for editing.

b) After inputting the data into a file in ISO 2709 format, we may use our program to send automatically-generated subject terms and indexes as well as other data fields to form a new ISO 2709 data file. Then, through the CDS/ISIS controller to transfer the data to the main database by CDS/ISIS. In this way, we need to transform the data twice. However, technicians may use the CDS/ISIS full screen editing function, which they feel is efficient and helpful. The technical problems in these two methods have been dealt with by the author of this paper. At present, we use the second method for construction of our databases. The transforming program has the capability of error testing for input grammar. If technicians should input by way of angle brackets for Chinese characters, but he/she uses ; ! ? or @ in ASCII instead, the program will flag all the record numbers which have errors for editing.

3. Record Control Numbers Given by Computers and Automatic Forming of the Chinese Subject Indexes

There are two ways to search the Chinese agricultural documentation database. One is to search by computer and the other is by printed materials such as author and subject indexes, searching concepts indexes, and subject scope tags indexes. For manual searching, there must be a record control number. Each record control number is assigned according to the classification sequence of the documentation. As data for the Chinese agricultural documentation database is accumulated by the National AGRIS Center and the seven subcenters, the automatic assignment of record numbers makes it easier to form the subject, author, and subject concepts indexes as well as the scope tags indexes.

4. System Evaluation

The Chinese agricultural documentation database now contains over 30,000 records which have automatically formed subject index entries. After many tests, the computer edited subject indexes seem reasonable and standardized. The average indexing depth is 4.05. This technique has been introduced at all seven regional subcenters and they feel that this technique is helpful in promoting indexing efficiency and quality.

The characteristics of the system are as follows:

1. The system takes advantages of CDS/ISIS software and uses the program to create subject terms and indexes to make up for shortcomings of CDS/ISIS.

2. The system uses nine function tags which are easy to use. It includes all types of subjects and forms reasonable and standardized subject indexes and subject terms. Also, it will not influence data in other fields.
3. The record control number assigned by computer can save labor and time as well as ensure record quality.
4. At present, the key words and function tags of the system are still assigned by librarians. On the basis of the present system, if we continue to develop it and try to have the function tags be combined with a key words automatic distribution system, it could be very helpful to have automatic indexing and editing of subject terms and indexes within the indexing process.

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SEAWIC: Its Organization, Objectives and Activities

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Abstract

The Southeast Asian Weed Information Centre (SEAWIC) was established in December 1985 at the Southeast Asian Ministers of Education Organization Regional Centre for Tropical Biology (SEAMEO-BIOTROP) with financial assistance from the International Development Research Centre (IDRC), Canada. It was to collect, process and disseminate information on weeds of Southeast Asia (SEA) and their management.

A database, now consisting of about 4,000 citations of information on weeds and related fields, has been created from published and unpublished reports organized by the SEAMED-BIOTROP library. SEAWIC also has a weed herbarium collection presently consisting of 4,416 specimens belonging to 850 species. The data on the collection has also been computerized.

Both information resources have been used by different SEAWIC users such as researchers, lecturers, students, extension workers and herbicide manufacturers and salesmen. SEAWIC has also provided other services like literature searches, weed identification and other forms of information dissemination on weed biology and management. These information services are backed up by a document supply service in the form of photocopy and publications like the *Weedwatcher*, *Weed leaflet*, *Annotated Bibliography* and *List of Indexed Articles: Special Edition on Weeds*. The SEAMEO-BIOTROP Tropical Agricultural Pest Biology (TAgPB) programme in cooperation with SEAWIC organizes training and workshops on weed science and management. SEAWIC also serves as the secretariat of a network of weed scientists from the region. Although most of its clientele are from SEA, requests for services are also received from outside the region.

SEAWIC plans in its Phase II to expand its services to grassroot levels by instituting an expert system on Weed Identification and Management basically for use by extension workers, educators, farmers and the general public. A *Weed Info Sheet* containing information on the biology and management of selected important weed species will also be produced.

1. Introduction

Weeds represent a highly successful and biologically important component of a dynamic agroecosystem. With the ever-increasing population especially in developing countries, there is a continuous demand for greater food production but some good agricultural lands have been converted to residential or industrial areas. The agricul-

tural production system is thus working with less area and lower land quality and yet it must produce high yield to meet the ever-increasing demands. Under such conditions, only a small yield loss due to weeds could be tolerated by the system. A more sophisticated weed management programme must be developed and be made available to farmers and other users in the field in a faster and more efficient manner. The fight against weeds, from the recognition of the weed species to its control and prevention of regrowth, requires much information. This is available primarily from books, journals, research notes, technical papers, institutional or governmental publications, proceedings of scientific meetings, masters theses or doctoral dissertations and others. With the present information explosion, there is a need to screen, collect, process and disseminate relevant documents. Researchers, agriculturists, lecturers and students have been desirous of an institution in Southeast Asia that could provide such services on weed information management. Through the Southeast Asian Weed Information Centre (SEAWIC), the Southeast Asian Ministers of Education Organization-Regional Centre for Tropical Biology (SEAMEO-BIOTROP) hopes to answer such needs.

The Tropical Agricultural Pest Biology Programme (TAgPB) of SEAMEO-BIOTROP, through its Weed Biology and Management Sub-Programme as well as its Integrated Pest Management activities, is actively involved in research and manpower development in weed science and management. It conducts short-term training courses and organizes symposia on various aspects of weed biology and management.

On the other hand, the Clearing House of Information (CHI), collects, processes and stores information in the field of weed science. To be able to meet such demands and to speed up its services, CHI has created several computerized databases of selected information taken from incoming library materials. A copy of the document is thus also available. Among the areas covered are various aspects of weed biology and weed management (utilization and control). SEAMEO-BIOTROP therefore integrated the activities on weed biology and management of the two programmes into a project called SEAWIC.

2. SEAWIC Phase I

2.1. Organization and Objectives

The SEAWIC Project was established in December 1985 by SEAMEO-BIOTROP with initial financial assistance from the International Development Research Centre (IDRC) for a period of three years. It has since been extended through June 1990. The project involved the Tropical Agricultural - Pest Biology (TAgPB) and the Clearing House of Information (CHI) programmes. The head of the TAgPB programme is responsible for the technical aspects of the project while the manager of the CHI programme is in charge of the information component. The entire project is under the supervision of the Deputy Director for Programmes. The organization chart is shown in Figure 1.

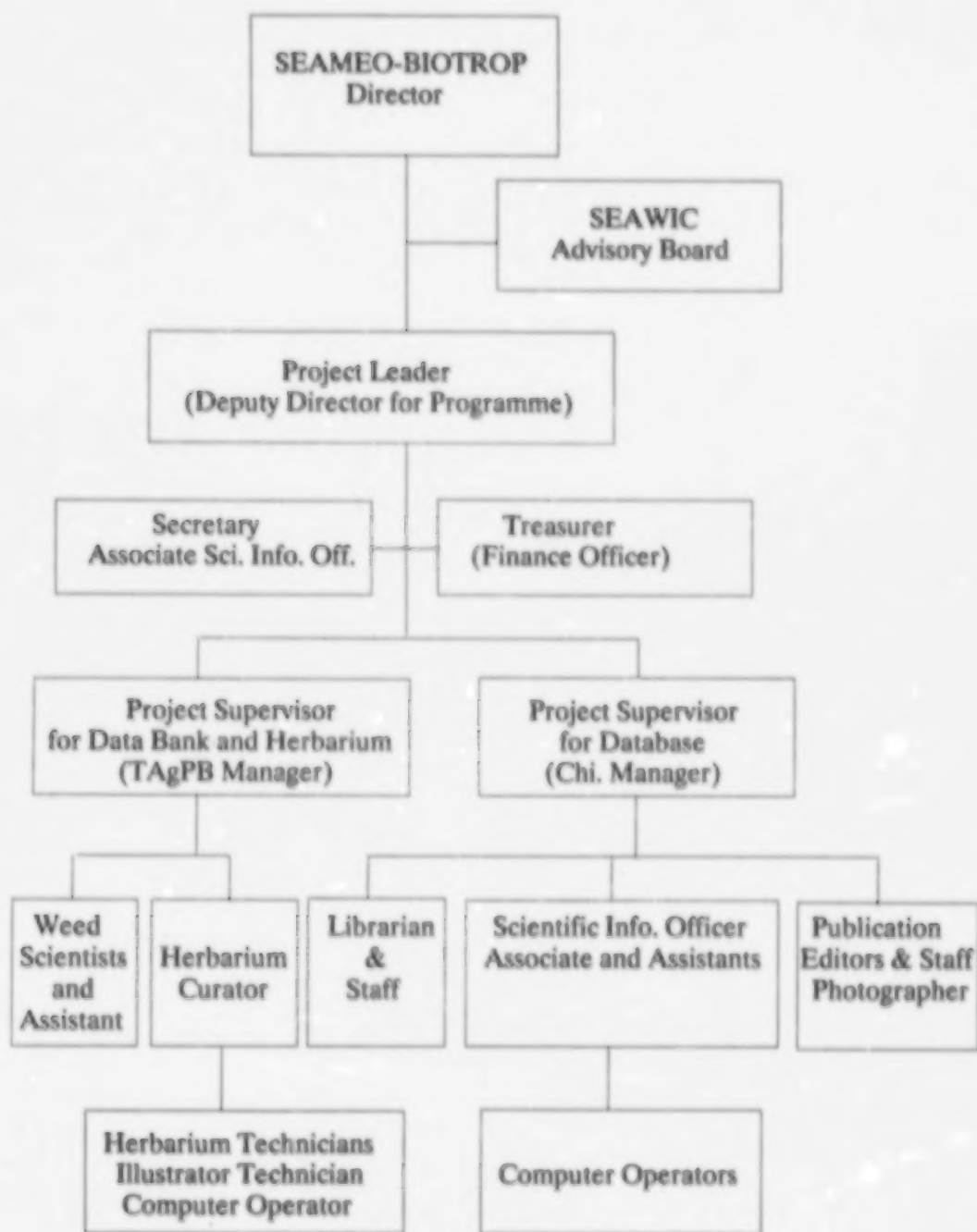


Figure 1. SEAWIC Organizational Structure

SEAWIC was created to gather, store, analyze and disseminate information on Southeast Asian weeds and related subjects.

2.2. Scope and Beneficiaries

The weed information covered by SEAWIC in Phase I included weed taxonomy and other aspects of weed biology specially morphology, physiology and ecology. Also included is information on losses caused by weeds, weed management (i.e., weed utilization and control) mode of action and bioassay of herbicides, impact of the application of herbicides on the environment, and other related topics.

The main geographic areas covered were Southeast Asia and neighboring countries, but others were also served upon request. The beneficiaries of SEAWIC Phase I were mostly researchers (56%), faculty members and students (47%), planners, decision makers, extension workers (7%), agrochemical companies (2%), agricultural producers (1%), agricultural contractors, government agencies, inland fisheries operators and the general public (18%). (The sum is more than 100% because some users belong to more than one category.)

2.3. Activities

a. Database

For the SEAWIC project, acquisition of information on Southeast Asian weeds was intensified by ordering grey literature through contact institutions in the region or through contributions from the SEAWIC subscribers. Access to the existing information in the region has also been made possible through a system of networking of persons and institutions established by SEAWIC staff.

A database called WEEDOC has been created containing information on weeds of Southeast Asia and other related fields. It includes tropical weed entries from both published and unpublished materials already found in the SEAMEO-BIOTROP index. Other literature generated in Southeast Asia and materials listed in international databases such as CAB and AGRIASIA are added regularly to these bibliographic entries. The database has been used to provide literature searches and selections for entries in the semi-annual SEAWIC publication, *Annotated Bibliography*.

Since its creation in 1987, the WEEDOC database has continued expanding and now contains 3,450 searchable records. An additional 700 records have been created and are presently in different stages of editing using the WordStar software. Only after they are considered "clean" can they be transferred into the database using the INMAGIC software. Scanning of library materials for the WEEDOC database is done regularly and results in the entry of selected information into the computer.

Another database called RESABS was created based on reply sheets sent to researchers on the SEAWIC mailing list. The data in the RESABS database were published in the newsletter of the SEAWIC project *WEEDWATCHER*, under the headings "Current Research Results," "Needs and Offers" and "Who is Doing What Weed Research." Thus,

people working on weeds and related subjects are given the opportunity to have their findings made known immediately, to advertise what they can offer, and to reflect what they need.

b. Herbarium and Data Bank

With the establishment of SEAWIC, the existing SEAMEO-BIOTROP weed herbarium collection was greatly improved. It is now properly mounted, labelled and kept in steel herbarium cabinets where it is arranged alphabetically by families. The present collection consists of 4,416 specimens belonging to 93 families and 850 species. There is also a collection of 139 seedling specimens and weed seeds of 466 species.

A total of 393 specimens were donated to the SEAWIC Herbarium by scientists from the Philippines, Singapore, Thailand and Australia. Requests for weed specimens and weed seeds have been received from Malaysia, Switzerland and the U.S.A. Scientists, lecturers and students from Indonesia and other SEA countries have requested assistance in the identification of weed specimens.

Field trips to Java, West and North Sumatra, South Kalimantan, South and North Sulawaesi were made in 1987-1988 to collect weed specimens, to identify weed problems in the area and to establish contact with weed scientists from the region. A total of 285 specimens were collected during the trips.

The database HERBAR contains information on each herbarium specimen. Information on the weed habitat, description, economic importance and method of control are included. The herbarium records based on field notes together with some information from references appear on the herbarium labels. The data include: (1) botanical and vernacular names, (2) Synonyms-family, species, (3) Collector and collection number, (4) Location, (5) Notes.

All data pertaining to each weed identified have been written on a worksheet and stored in a computer using the INMAGIC software. With this, an automated system of label making was developed and information on each species can be searched. The worksheet is based on the herbarium specimens and on data from references. At present, 4,386 worksheets have been prepared and a total of 2,375 records have been entered in the computer (1,300 entries are searchable) and 325 labels have been printed.

c. Publications

(1). The *Weedwatcher*

The quarterly newsletter of the SEAWIC project is called the *Weedwatcher*. A total of twelve issues have been published. It has received very good response not only from weed scientists in the region but also from other countries in Asia (India, Sri Lanka,

Japan and Bangladesh), Africa and Latin America. The present mailing addresses started with only 304 in 1986 but additional requests still regularly come by mail.

(2). *SEAWIC Annotated Bibliography*

The *SEAWIC Annotated Bibliography* is published semi-annually as an output of selected citations taken from the WEEDOC database. Materials included are mostly grey literature generated in Southeast Asia and very recent information appearing in regional or international conferences. It has also received favorable review from users as reflected in the many requests for copies of the original documents cited in the bibliography. A total of six issues have been published up to the present with 100 entries per issue.

(3). *The Weed Leaflet*

The *Weed Leaflet* is published as an occasional supplement to the *Weedwatcher*. To give a regional flavor to the publication, contributions from Southeast Asian countries are solicited. At present only five issues have been published.

(4). *List of Indexed Articles (LIA): Special Edition on Weeds.*

The bibliography is a complete listing of records taken from the SEAWIC database. It is published every two months with each issue containing about 150 citations.

(5). *Promotional Brochure*

The promotional brochure came off the press in May 1989. It has been mailed to present and prospective SEAWIC clientele. It has also been distributed during weed science seminars, symposia and conferences in Indonesia and other SEAMEO member countries. It contains information on the SEAWIC structural organization, its activities and services, as well as an introduction on the membership fees for SEAWIC. The suggested charges are to serve as supplementary sources of funds for the SEAWIC project.

d. **Services**

(1). *Weed Identification*

SEAWIC provides a weed identification service in cooperation with the Herbarium Bogoriense where difficult specimens are referred for validation of identification. So far, only SEAWIC users from Indonesia, the Philippines, Thailand and Singapore have availed themselves of the service.

(2). *Information Retrieval*

The information retrieval service on weeds and related subjects has been facilitated by the creation of the WEEDOC database. Requests for literature research have been received not only from the region but also from Bangladesh, Brazil, India, Nigeria and Sierra Leone. (Table 1).

Request for Literature Search for SEAWIC		
Type of User	Amount	No. of Titles Retrieved
Researcher	24	1243
Lecturer	5	33
Extension Worker	2	10
Plantation Manager	1	10
Herbicide Marketing	-	-
Manager	1	32
Student	70	1174
Other	9	268
Total Amount	112	2770

Table 1.

(3). Document Delivery

To complement the information retrieval service, SEAWIC offers a back-up service by providing photocopies of the original documents. This service has been utilized extensively by researchers. On the average, SEAWIC supplies 1,200 documents to its users through the inter-library loan system every year. As SEAWIC is also a depository of grey literature produced in SEA, it is very convenient to contact just one source of information.

(4). Question and Answer

A number of enquiries regarding weed problems and other matters are also being received. In providing this service, the Database Group consults with the weed scientists of the TAgPB programme and the university in providing a satisfactory reply.

SEAWIC in accomplishing its activities and meeting its goals would require the help of its users both for their entries and evaluation as shown in Figure 2.

2.4. SEAWIC Evaluation

To evaluate the SEAWIC output and services, questionnaires were sent to 500 readers of SEAWIC publications, users of SEAWIC services and selected prospective users. A SEAWIC Evaluation Workshop was organized on August 30-31, 1988. It was attended by 35 participants representing government research institutions, universities, in

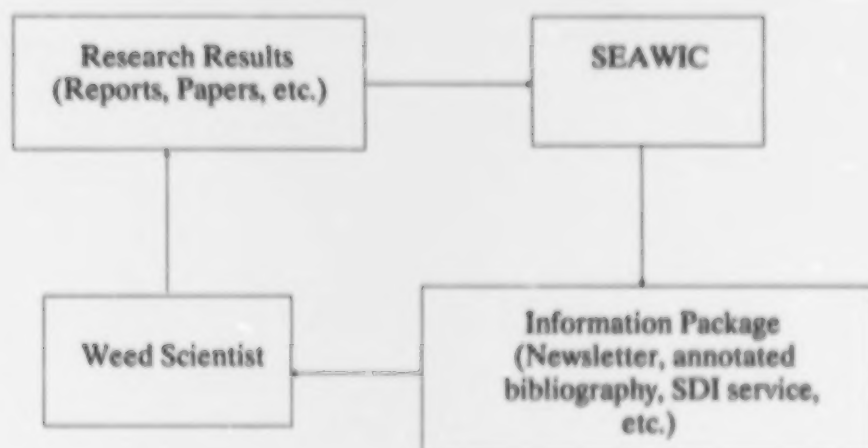


Figure 2. Interrelationship Between SEAWIC and its Users

dustrial crop plantations, national and international organizations of weed scientists as well as agrochemical companies.

A special session was also held to evaluate SEAWIC and to plan future activities during the SEAMEO-BIOTROP organized Symposium on Weed Management held on June 7-9, 1989.

In general, the scientists agreed with the need to strengthen and expand the services of SEAWIC. The continuation of SEAWIC publications like the *Weedwatcher* and *Annotated Bibliography* in the present format was recommended. A modification of the SEAWIC *Weed Leaflet* format to cover wider readership, i.e., the inclusion of extension workers and even farmers and the general public is being considered. The proposal of the herbarium curator on "The Application of the Expert System in the Identification and Management of Southeast Asian Weeds" was favorably endorsed by all groups. A request for continued support from IDRC to pursue current projects and to expand SEAWIC activities and services in Phase II is therefore being made.

3. SEAWIC Phase II

SEAWIC Phase II will include both a strengthening of the present activities and services, a modification of some and the organization of new ones specially aimed at extension workers, farmers and the general public who were not sufficiently covered in Phase I.

The weed information to be covered will still be that included in Phase I. However, since Phase II publications and activities will also be geared toward the benefit of community extension workers, farmers and the general public, more information on

weed identification and management practices appropriate to their needs will be explored and made available in suitable format and levels.

The geographic area to be covered will still be limited to SEA and neighboring countries with similar climate and cultivation methods. However, based on the many requests and responses coming from other developing countries, exchange of information will not be limited to SEA. Services to other countries will also be made available upon request.

SEAWIC will produce new information materials, e.g., the *Weed Info Sheet*, and "Expert System Output." Training courses will be conducted for people involved in extension work to produce teaching materials or repackage research results and reports. Special short-term training courses on herbarium curating and management, the use of computers to store herbarium data and information retrieval will also be provided.

Each issue of the *Weed Info Sheet* will be devoted to a particular weed of major importance. There will be a colored habitat picture, accompanied by line drawings of the most distinguishing characteristics of leaves, flowers or other features useful for identification. This is to supplement the short description of the weed based on information available from the expert system database. The *Weed Info Sheet* will also contain data on the weed's scientific name, some common local names, habitat, distribution, mode of reproduction and spread, problems it causes and its management. The information will be taken from available databases at SEAWIC. A total of 45-50 *Info Sheets* covering the most important weeds of different commodities and regions is planned. Each *Info Sheet* will be printed on good quality paper which can be laminated or enclosed in plastic sheets so that it can even be brought to the field by extension workers and farmers if necessary. They could easily be compiled by scientists or students based on families, commodities or region. The original material will be in English but participants of the training course on Information Repackaging for Trainers may be required as one of their activities to translate these into major Southeast Asian languages. The printing of these *Info Sheets* into other languages will be the concern of the individual nations.

The Selective Dissemination of Information (SDI) service which could not be implemented in Phase I will be made available in Phase II. There are now sufficient entries in the existing database to make the initiation of an SDI service possible.

The proposed "Expert System" is aimed at non-specialists like extension workers, farmers, teachers and the general public who may have problems with weed identification and management. The information would range from the quantitative including statistical relationships to less precise general rules of thumb or hunches developed from hard-gained field experience. The expert system could also be connected to the database through an external program. This would be particularly useful in making decisions or recommendations when only limited data are available from the users. Thus, the information in weed identification and management integrated into an expert

system would permit the sorting out of data and their organization into a package of suitable programmes to answer specific field problems.

4. Summary and Conclusion

SEAWIC during Phase I of its existence has collected, stored, analyzed and disseminated information on weeds of Southeast Asia through its database, publications, training courses and symposia. In Phase II, the project is hoped to strengthen and expand its present activities and services by including not only researchers and members of the academic community but also extension workers, farmers and the general public among its clientele. New services (SDI), new publications (*Weed Info Sheets*) and the use of an expert system in weed identification and management are envisioned in Phase II. These are all aimed at improving the information system on weed biology and management so that an increase in yield of agricultural systems could be assured.

Strengthening the Establishment of a Chinese Regional Monographic Agricultural Document Database

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Abstract

First, this paper discusses the local superiority of Chinese agricultural reference documents, cites some local agricultural publications and briefly analyzes the utilization of agricultural documentation resources and the existing situation of China's information science and technology. The authors hold that the establishment of a monographic agricultural document database not only meets the needs of our era but is also an effective strategy to exploit the local advantages of China's agricultural document resources as well. The paper puts more emphasis on a significant discussion of existing conditions, technical approaches, and developing a strategy for establishing a regional monographic database in China.

Nowadays, agriculture based on natural resources and traditional experience in China is changing into one with scientific knowledge and modern techniques as the base. The effects of science and technology in modern agricultural production is becoming more and more important. The 60-80% increase in agricultural production in the developed countries depends on the progress of technology. As the medium and carrier, the documents of agricultural science and technology are one of our special agricultural information resources. The exploitation and utilization of which have an important role to play in the course of modern agriculture. How to increase the exploitation and transmission of agricultural documents in science and technology is always a major task in the sectors of agricultural science and information technology.

1. The regional characteristics of China's agricultural documentary resources

As a special kind of agricultural resource, agricultural documents have a close relationship with agricultural production and scientific research, and in return, agro-production and agro-scientific research activities are the resources of agricultural documents and information. At the same time, agricultural documentation information reacts to agricultural production and agro-scientific research, guides it, and pushes it forward.

China is a large country with different natural conditions (including climate, topography, soils, organisms, etc.), different areas, and different economic environments. These differences result in the fact that agricultural production and agro-scientific

research have strong regional superiority, and also causes agro-science and technology documents to have a large regional distribution, thus forming different superior special documents resources in different regions.

Let's begin to examine the journals published in four main regions in China: the southern part of China is the region for tropical crop production. The journals *Research on Crops*, *Research of Tropical Crops*, *Reference Materials of Tropical Crops*, *Science and Technology of Tropical Crops*, *Transactions of Tropical Crops*, and *Sugarcane and Sugar*, etc., are published in this region. The eastern part of China is a major region of silkworm and tea production. The journals *Science of Silkworm*, *Abstracts of Silkworm*, *Foreign Agriculture--Silkworm*, *Tea of China* and *Abstracts of Tea*, etc., are published in this area. The northeastern part of China is a major region of soybean production where the journals *Science of Soybean*, *Foreign Agriculture--Soybean* and *Abstracts of Soybean*, etc., are published. Moreover, in the journals of general agriculture, the number of papers on soybean are obviously more prevalent than those on other subjects. The Northwestern part of China is the region of animal husbandry production. Among the 52 journals on animal husbandry and veterinary medicine published in China, eighteen are published in the northwestern region. Major arid agriculture production is also in the northwestern part of China. The journals *Research on Agriculture in Arid Regions*, *Abstracts of Agriculture in Arid Regions*, *Journal of Geography in Arid Regions* and *Research of Arid Regions* are published in this region. The regional distribution characteristics of the above agricultural documents are shown not only in the professional journals but also in the comprehensive agricultural publications, the proceedings of research papers and notes of seminars and even in agricultural books. For instance, the *Shaanxi Journal of Agricultural Sciences* has a special column for rainfed agricultural research. The comprehensive agricultural journals published in Yunnan and Guizhou provinces have a large number of papers on tobacco science and technology. The Rainfed Agricultural Research Laboratory of Shaanxi Province has contributed "The Selection of Rainfed Agricultural Information in Arid and Semiarid Areas in China," etc. This characteristic in China's agricultural science and technology information work can not be neglected.

2. Establishment of a regional monographic database of agricultural documents

With the development of the world database industry, the Chinese scientific and technological information cause is now in a period of transition from a traditional mode to a modern mode of database development. Construction of a database on agricultural documents is in its beginning stage. There are seven special databases being constructed, and another four databases are planned to be set up on a small scale, dispersed, and in a specific subject specialty with obvious regional characteristics. The Database of Sesame Documents set up in the Academy of Agricultural Sciences of Hebei Province, the Database of Scientific and Technological Documents on Tropical or Sub-tropical Fruits set up in Guangxi Agricultural college, etc., are examples in this field. The establishment of a database of agricultural documents not only meets the needs of our times, fits the developmental trend of scientific and technological infor-

mation, but is also an effective strategy for agro-document resource exploitation and utilization.

The regional features in agricultural production determine the forms of agricultural documents. In return, the demand for agricultural documents by agricultural production and scientific research also have regional features. Statistics on the utilization of publications in our library shows that the number of consultations of the *Shaanxi Journal of Agricultural Science* by scientific research personnel and the utilization ratio are significantly higher than the numbers for journals in other regions. This shows that regional publications have a high value of utilization with strong local characteristics. Based on the dispersed characteristics of agricultural document resources and taking advantage of different professional document resources and different demands for different professional documents in different regions, we can establish a monographic database for agricultural documents and information in dispersed distribution arrangements. It will not only reflect the level and development of agro-science research of the region, adapt to the needs of document information for different special research, but also can develop the regional document resources, and provide an effective agricultural information service for the region.

2.1. At present, some basic conditions for the regional agricultural document database establishment have changed greatly with the start of the monographic database establishment.

2.1.1. China's agricultural information system has been formed after ten years' efforts. It consists of the national center, the seven regional subcentres, thirty agricultural institutes distributed in more than thirty provinces, municipalities, autonomous regions, seventy agricultural colleges and universities and more than forty national professional research organizations, libraries and information sectors. Agro-science information units in different districts have cooperative organizations with different forms, doing an effective job in coordinating the distribution of documents to achieve the sharing of resources, developing information research, exchanging experiences, etc., thus laying an organizational basis for the establishment of the regional monographic database.

2.1.2. There are a large number of comprehensive, special publications and retrieval journals which report agricultural information both at home and abroad.

2.1.3. Some units affiliated with the central agricultural libraries and information centres, agricultural colleges and universities have been equipped with microcomputers or minicomputers. The seven regional subcentres have also been equipped with IBM PS/2-50 microcomputers.

The basic hardware conditions are ready for the establishment of regional monographic databases.

2.1.4. The Chinese character processing techniques are being perfected. A lot of national standards on information processing and document publishing, such as the

Format for Documentation Bibliographic Information Interchange on Magnetic Tape (GB2901-82), Document Subject Title Rules (GB3860-83), and Retrieval Journal Catalogue Rules (GB3973-83) have been published, thus laying a solid foundation for the standardization of computer processing of agricultural documentation and information.

2.1.5. The establishment of the National AGRIS Centre and seven regional AGRIS subcentres laid the foundation for the regional monographic database establishment, and provided database creation experience. The authors are members of the northwestern AGRIS subcentre and took part in the construction of the Comprehensive Database of Chinese Agricultural Documentation Bibliographies, and were involved in the work of collecting, analyzing and processing documents. We find, among fifty different journals in agriculture, sixteen are journals on animal husbandry and veterinary medicine. Among the 1,000 records inputted in the database in the first half of 1989, 540 were on animal husbandry and veterinary medicine. According to the Compilation of Names of Scientific Research Institutes and Institutes of Developing Techniques in China, there are 129 institutes of research on animal husbandry and veterinary medicine in China, and 28 of them are in northwestern China. The number of institutes in northwest China is eleven more than the average number for the other six regions.

This figure shows that the large number of documents on animal husbandry and veterinary medicine is a majority of the agricultural documents in northwest China. These kinds of documents are the local areas of necessity for documents and of information services in northwest China. In fact, there is a local characteristic to documents input in the other subcenters, such as aquatic product documents in central China; documents on wheat, barley, triticale, etc., in north China; basic subject research documents in east China, etc. We feel that when the AGRIS centre and subcentres in China established the national comprehensive database of documents, they laid the foundation for constructing regional databases of documents.

2.2. On developing a strategy for a regional monographic document database.

2.2.1. To strengthen integrated programs, make sure to coordinate their development. For problems existing during the early development of the monographic database, it is necessary to bring the superiority of macroscopic control at the national level into full play with the further development of the monographic database, with overall planning for the structure of the system, its distribution, the range of subjects, and to ensure a rational design, concentrated aim, and better applicability.

The electronic computer retrieval system should be expandable to become an agricultural information system for the whole country, including farming, animal husbandry and fisheries. Coordination with retrieval publications systems, agricultural science organizations, and agricultural colleges and universities, should be ensured.

2.2.2. A proper dispersed treatment and cooperative establishment of the database must be practiced. The collection of documents is an important step in setting up the database, and it is a major source for data to input. So the scope of collecting documents should be extensive and cover all subjects. As prices of journals and books rise in China, the quantities of documents acquired becomes smaller and smaller. But the advantage of socialism makes strengthening of cooperation easier, so that we can establish the monographic database mainly by using documents in our own collections, we can also consider the method of shred collection development in accordance with provinces' strengths and specialties. First, every academy, college (or university), and professional institute throughout China should take up the collecting, and pre-processing of data for different professional documents. And then, each of the seven AGRIS subcentres should serve as an authorized regional centre of professional document retrieval, and undertake the establishment of the monographic database, including inputting data and document retrieval. Finally, this system of document collection and processing of professional agricultural data should conform to that in the seven AGRIS subcentres. If the system combines with the national comprehensive database and becomes a subsystem of the national database, this will increase the speed of establishing the database, enlarge the amount of data, improve the applicability, and will also give full rein to the superiority of each locality, and reduce investment costs.

2.3. Technical tactics on the establishment of the regional monographic document database.

2.3.1. On the computer system. There is no doubt that establishing databases using microcomputers is a suitable technical approach in China and other developing countries, because of its small investment and low environmental requirements. Thus, as far as the establishment of a regional monographic document database is concerned, microcomputers are very suitable for small-sized databases and dispersed data processing. At present, there is a kind of super microcomputer with 620Mb hard disk and 4Mb RAM, whose price is only 1/5 to 1/3 that of a minicomputer. Furthermore, a microcomputer has the advantages of ample software, a short period for software development, and being easy to operate, etc. Thus, no priority is given to the selection of a minicomputer during the establishment of the regional monographic database, but attention must be paid to enhanced functions, and consideration should also be given to the performance of a main computer which can be used as a file server.

For computer storage systems, the capacity of a floppy disk is obviously too small, but its utilization for data collection and interchange is effective at present. A harddisk is too expensive and is not easily transportable. CD-ROMs are mainly used for foreign database retrieval at this early time. The magneto-optic (MO) disk is the ideal selection for information retrieval, but, it will take a period of time before it is used widely in China. There is also a kind of "removeable harddisk," which can be used like a floppy disk, whose capacity is 20Mb, and with a search speed approaching that of a harddisk. This "removeable harddisk" is very suitable for the establishment of regional databases. It may be considered for use in database storage and retrieval, and in the national database storage and annual data exchange. But close attention should be paid to MO disks; once the conditions are ripe, the MO disk must be used as early as possible.

2.3.2. Data collection and interchange. The establishment of a computer network should not be considered at least for 3-5 years, because of restrictive conditions and low utilization. The data collection and data exchange activities may also use floppy disks.

2.3.3. The regional databases must be standardized in three aspects; that is to standardize the database structure, the data interchange tapes, and the language of retrieval, because of considerations for convenient cooperation, compatibility, transformation between systems, maintaining unanimity, improvement of the quality of the database and the effect of service. First, CDS/ISIS (the version which can process Chinese characters) should be considered. This is good microcomputer-based information retrieval software. The data interchange standard is ISO 2709 which allows exchange of data between small and large computers. As for the language of retrieval, the Agricultural Descriptor Language edited by the Chinese Academy of Agricultural Sciences should be considered. The National AGRIS Centre and the seven subcentres have done a good job in starting the establishment of the Comprehensive Database of Chinese Agricultural Documents, and their experience can be used for reference.

2.3.4. To augment the equipment in the regional AGRIS subcentres with computers for data input and facsimile capabilities added, will make the regional AGRIS subcentres become the core of the regional monographic database establishment.

The storage capacity of the PS/2-50 microcomputer provided for every regional AGRIS subcentre is too small (the harddisk is only 20Mb). The early edition of the CCS Chinese Character Processing System for the PS/2 is not fit to do the large quantities of tapes of Chinese characters. It is suggested that the harddisk and control card be changed to raise the capacity to 60Mb, with an external 5.25 inch floppydisk drive for easy data exchange with XT's, AT's or the same model in order to fit the necessary and gradual increase in data input.

3. The tentative plan and preparation for the establishment of the animal husbandry and veterinary scientific document database.

As we described before, northwest China is the main area for animal husbandry, and the information services emphasize the literature of animal husbandry and veterinary science, and have an obvious superiority in animal husbandry and veterinary science document resources. Because of these characteristics, we are prepared to establish the Animal Husbandry and Veterinary Science Document Database with the characteristics of northwest China, simultaneously with the establishment of the national comprehensive agricultural document database. At present, we have done some preparatory work. First, we have investigated the resources of animal husbandry and veterinary science in our country, we have strengthened the collection of related documents, and paid attention to the quality of the information indices. Then we separated the sub-database of animal husbandry and veterinary science from the comprehensive database. So far we have accumulated about 4,000 records. We plan to go further and get funding for the establishment of the database from various sources.

We wish to get help from the national centre, as well as assistance from related sectors. Although we are facing lots of difficulties, our aims will finally be attained when we establish the agricultural database, in order to exploit local agricultural document resources, raise the utilization efficiency of documentation, develop agricultural production, and promote agricultural scientific research.

As far as the Chinese agricultural information sectors at present are concerned, the establishment of the Chinese Agricultural Documentation Comprehensive Database is the main task of China's agricultural retrieval system, but the development of a distributed, small-size, standardized monographic database with regional features according to the regional characteristics of China's agricultural scientific research, production, and document distribution can form a "distributed database" by using the superior computer retrieval capability of the seven subcentres. If suitable exchange methods are adopted, the whole system will have a lot of the merits of a distributed database. It can be expected that with a high utilization ratio, better economic and social benefits will be obtained. If the monographic database establishes synchronized intersects with new information techniques including video-audio information, micrographics, facsimile, computer typesetting, laser printing, etc., the level of new information techniques can be improved quickly. Just as we have found that after computer typesetting and laser printing systems have been installed, the speed of agricultural document typesetting and printing has been greatly accelerated, also better economic returns and social benefits have been obtained, thus creating better conditions for the publishing of retrieval publications and starting a new field of research on the establishment of new integrated information techniques.

Indonesian Plan for an Integrated Management Information System for Agricultural Research and Development

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Abstract

The Agency for Agricultural Research and Development (AARD), Ministry of Agriculture, Indonesia is establishing a Management Information System. The AARD-MIS has started with sub-systems on Research Programs, Manpower, Research Funds and Research Facilities. The National Library for Agricultural Sciences (NLAS) is assigned to formulate the Agricultural Science and Technology Information Network as a sub-system of the AARD-MIS.

The paper discusses the status of the agricultural information network in supporting the AARD-MIS and the MIS of the Ministry of Agriculture. Some of the problems of the network are presented for future development. It also discusses the applications of information technology.

The agricultural information network has been initiated since 1971 by resource sharing activities among the agricultural libraries in Indonesia. As the National Library for Agricultural Science (NLAS) is the strongest among the other agricultural libraries in the country in term of its collection, facilities and manpower, the NLAS has become the backbone to support the agricultural information needs in the country, and is considered to be the national centre of the agricultural information network.

The development of the agricultural network in the first decade did not proceed much because of lack of funds and facilities and also a shortage of skilled manpower to support the resource sharing activities. The situation has changed drastically, because information needs are steadily increased in line with the fast developments in science, technology, and agriculture, as well as in information technology. From manual methods with limited coverage and targets, the system can extend the coverage and audience by applying electronic and fibre optic technology. To increase the effectiveness of the agricultural information network, the system is linked with the Management Information System of the Agency of Agricultural Research and Development.

Development of the Agricultural Information System

Back in 1971 information storage and retrieval for agricultural information was done manually, using printed indexes and catalogs. Since 1975, the National Library has been involved in an international agricultural information system, AGRIS, and later with other international and regional information systems. Even with their limited skilled

manpower, facilities and funds, the experiences and involvement in information exchange in the international/regional information network, the staff has been encouraged to improve their capability in electronic information technology, e.g., microcomputers. The staff capability and experiences in handling information using the microcomputer are improving gradually by actively discussing their problems with an expert visiting the country, as well as sending the staff for training, both within the country as well as overseas.

For handling the information, in 1985 we only had an IBM PC XT microcomputer with 256 Kbyte RAM and a 10 Mbyte harddisk. At present we are using ten sets of microcomputers all with harddisks varying from 20-60 Mbyte, RAM varies from 512-2048 Kbyte. Micro CDS/ISIS software is used for handling the agricultural database and WordStar 4.0 and Ventura are used for editing the printout file in preparation for secondary publication such as bibliographies, book catalogs, indexes, abstracts, and a Union List of Serials. Aside from that the database is widely use for scientific literature services and Selective Dissemination of Information. The library can exchange its records by transferring them in ISO 2709 format and loading them into a new database or merging them if the same structure is used.

The Micro CDS/ISIS software was developed by UNESCO and was released in 1985, with the latest release being version 2.3. It is widely used in developing countries especially for supporting library and information activities.

To strengthen the agricultural information system at present the agricultural libraries within the Agency for Agricultural Research and Development are in the process of developing an agricultural database of their own agricultural research results. On the other hand to strengthen the link between research and extension, all the Provincial Information Centres of the extension agencies will use the same data structure used by NLAS. Even though online systems are not yet feasible for application, because of the telecommunication problems, data transfer using diskette can accelerate the information service. A double-sided, double density diskette can accommodate an average of 200 bibliographic records with abstracts. To support the researchers with agricultural information from developed countries, the NLAS subscribes to the AGRICOLA and CAB databases on CD-ROM, in addition to the AGRIS CD-ROM.

Management Information System

The Agency for Agricultural Research and Development, at present is in the process of developing a Management Information System (MIS) which aims:

- To build a database applied to research programs, personnel and research facilities.
- To prepare the manpower for supporting the MIS at all levels within the organization.
- To provide the hardware and software facilities to support the data processing of MIS at all levels within the organization.

- To develop a computer design and programs for the database and its data analysis and also its utilization of the database by policy makers.
- To process and analyze the database and other supporting data to provide data for decision making and planning.
- To prepare a procedure for MIS at each level in the organization.

For the long range the MIS will have the following objectives:

- To develop a procedure for updating data regularly.
- To provide the required facilities and skilled manpower.
- To improve the program for processing and analyzing the database and updating data to support the decision and policy makers at all levels within the organization.

At present the MIS of the Agency for Agricultural Research and Development covers five subsystems:

- (1) Research programs;
- (2) Research personnel;
- (3) Research funds;
- (4) Research facilities;
- (5) Information on research results.

To improve the effectiveness of the agricultural information network, the system is linked with MIS, especially with the first and the fifth subsystem, but using more simple worksheets and formats according to the needs. The above linkage will (1) Accelerate the gathering of information from the non-published documents which are known as non-conventional literature. More than 60% of agricultural information sources are based on non-published documents; (2) Allow for efficient use of the hardware; (3) Allow accessibility to the current research results for policy makers. As a result the impact of this linkage will extend to the information users, which will reach not only the scientists and researchers but also the policy makers.

Agricultural Information Dissemination

To improve the effectiveness of agricultural research and technology information, the methods for information dissemination are linked also with research communication. In other words the information dissemination of agricultural research and technology is a subsystem of the research communication program.

The communication of agricultural research results is done through various activities such as:

(1) Scientific meeting, i.e., Seminar, Symposium, Workshop; either national or international level;

(2) Publication as a medium for agriculture research results, either as scientific publication or technical publication;

(3) Meeting with extension as well as its users.

a. Field day, is a forum for dissemination and discussion of

- research results in the field which is attended by researchers,
- extension workers, policy makers, farmers/fishermen and other users. During field day, researchers can get feedback directly from the farmers for formulating their research programs.

b. Research Extension Consultative Meeting is a forum between researchers, research managers, extension workers and other agricultural officials and the key farmers/fishermen to discuss the utilization of research results and its field problems.

c. Technical meeting, is a forum for discussion of technical problems in agriculture in general or specifically on research and extension.

d. Information and library service.

The above linkage is aimed at extending the information coverage and bringing the research and technology information closer to its user. With this effort the utilization of research and technology information will be heightened and the support of manpower, facilities and funding will be increased.

Technical Problems

1. Online access in the network is not feasible yet because of telecommunication problems.

2. Loss of data on the harddisk because of electrical problems which require several sets of back-up diskettes because the diskettes are very sensitive to dust and humidity.

Conclusion

To strengthen the agricultural research and technology information network, there is a need to increase the effectiveness of its usage, which is done by linking with other available information systems which have the same objectives.

Creation of an Information Database and a Developmental line of Agro-Information Retrieval Techniques in Northeast China

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Abstract

As work in agricultural sciences is going on, a great number of documents are produced in northeast China every year. The study on construction of a database for agricultural documents and developing a line of information techniques should be combined with regional conditions. While introducing and using databases from foreign countries, we must pay close attention to establishing a group of specialized databases which are much needed in the northeast. On the basis of available projects for information collection we should expand our range of information in identification, collection, and processing to improve the quality of the databases. In the development of information techniques, a comprehensive line offering a gradual transition from manual and off-line searching to online searching should be adopted and a microcomputer-based information retrieval system combined with high density storage technology should be established to increase flexibility and improve the initiative of information agencies in providing service.

Although the establishment of a database and the work of agro-literature searching by computers in northeast China is only in an initial stage, we have already made some progress in the past two years. In order to promote the information service and broaden the range of service, in this paper we are going to probe into the construction of regional databases for agro-literature and information as well as the line of technological development.

I. The Production and Utilization of Agricultural Literature and Its Database in Northeast China.

The Northeast Sub-centre of AGRIS in China provides service to the provinces of Liaoning, Jilin and Heilongjiang. The total acreage of which is 790 thousand square meters and the population is more than 98 million, distributed in 45 cities and 145 counties. Northeast China is not only an important industrial base but also a chief base for grain production. The total farming population is 56.84 million with a cultivated area of 16.352 million hectares. The annual output value of agricultural production amounts to 35 billion RMB. Statistics show that there are 65 agricultural research institutions at the municipal or provincial level, and 51 colleges or universities of agriculture, forestry or aquatic industry in the region. The collection of books in the

libraries of the above institutions is more than 4 million volumes, and the agro-periodicals in Chinese and foreign languages are about 2,000 titles. There are 12,100 staff members who conduct research or teach in the above institutions, and undertake several hundred scientific research programs each year assigned by the government, ministries or universities. The publication of books or periodicals on agriculture or related subjects is about 350 volumes each year, out of which 13,200 articles of academic literature are produced. Each year there are 25,000 persons who come to the information centres for information, consultation, or searching. Influenced by factors of geography, climate and staple crops, the literature on the research of soybean, maize, sorghum, potatoes and sunflower is mainly produced in this region, accounting for a certain ratio among the various types of agro-literature.

Along with the development of science and technology, people need literature and information imperatively. In recent years, some agro-institutions of research and teaching in the northeast have purchased a number of computers according to their individual conditions and requirements and have established some small-sized databases or administrative systems. Considering the current administrative divisions in China and the present system of information collecting and processing, it is necessary to strengthen the establishment of information retrieval systems and bring the functions of regional agro-information centres into full play.

In order to overcome the difficulty in gathering agricultural documents and improve the backward information retrieval system, since 1984 the agro-academies and universities in the three provinces of the northeast have started their retrieval service by mail with the help of magnetic tapes from the CAB and AGRIS databases introduced by Sciencetech Documentation and Information Centre, CAAS. In 1988, our institute, as an AGRIS sub-national centre in China, started providing English language bibliographies and abstracts of local agro-literature to AGRIS Headquarters and participated in the construction of the Comprehensive Database of Agro-Literature in China, which played an active role in solving the problems of local agricultural scientists, professors and teachers and administration staff to attain the goal of rapid and accurate searching for literature in Chinese both from home and abroad. It is therefore necessary to establish a number of databases adapted to local subjects respectively and provide information retrieval service in a timely fashion.

II. The Development of Online Searching and the Utilization of Optical Disks in the Northeast

Online searching has a history of about twenty years abroad. In China the business of international online searching started in 1981, and since then there have been 71 terminals established in forty cities throughout China. Industry and agriculture show great difference in their demands for online searching. The recent survey of 126 agro-information users in Liaoning Province reveals that only three of them use online systems, and the rest, 123 in all, do their searching manually. During the period of the "Seventh Five-year Plan," most of the agro-programs just depended on manual searching to decide on the establishment or identification of research programs. The low ratio

of using online systems lies mainly in the inherent technical problems, language obstacles for non-English-speaking countries and high cost. On the other hand, as agro-research relates to the local environment and to specific tasks, the demand for literature retrieval in Chinese is much higher than that in foreign languages.

Along with the development of an online system, a new information carrier, Compact Disc-Read Only Memory (CD-ROM), has been created in the last two or three years. CD-ROM, characterized by high density and large storage capacity, is becoming a new kind of information carrier apart from magnetic tapes and disks. The platform for operating a CD-ROM is the IBM/PC computer which is popular in China. A CD-ROM can have its own retrieval system without going through communication lines and its cost is lower than the tapes and the disks. To establish a CD-ROM system is an economic and efficient choice considering the telecommunication situation in China. However, under present conditions, we are unable to transform Chinese language literature onto a CD-ROM because we lack a Chinese-character system for CD-ROM. In addition, we are now short of common CD-ROM databases owing to its short history in the world. The price of CD-ROMs in China is now still high and it has a low utilization ratio. In recent years, some institutions in China have begun using CD-ROM versions of LCMARC, NTIS, MEDLINE, LISA and ERIC, but those used in agriculture are only AGRICOLA and OCLC's Agricultural Series CD-ROM. So far as we know, there has been no CD-ROM database introduced to northeast agro-institutions. It might need a certain period from recognition to utilization.

III. The Creation of Local Databases for Agro-literature and the Developmental Line of Information Technology Services

Online networks and CD-ROMs would help to utilize databases abroad and improve scientific information processing technology in northeast China. However, we should study the construction of the regional databases and the developmental line of information technology based on local conditions, especially based on the practical status of the agro-scientific information business. We must not copy indiscriminately the experience of others.

China will benefit from the development of an online retrieval network in agriculture domestically, but the organization of the network needs high technology and investment, and especially needs reliable communication lines. It seems impossible for agro-institutions in one province or one region to solve such problems. It will take quite a long time to realize the goal. CD-ROM doesn't need communication lines and is regarded as a new-type of information carrier, but there are still problems to be solved in establishing a CD-ROM system since it is a new technology still being developed. Because we lack the technology and money, it is not realistic for us to develop CD-ROM systems in a short period in China. Our viewpoints for the creation of a local database and developmental line of information technology in northeast China are as follows:

1. The northeast is vast in territory and occupied by a large population. The three provincial governments in the northeast have put forward the policy of increasing

agro-investment during the "Eighth Five-year Plan," but all the activities need funds. It's not possible to get more funds for an information retrieval system from the government. Therefore, there is a big gap between the funding needs of the recent developing goal of information business and the investment available for it. As far as the developmental lines of information technology are concerned, we should adhere to the principle of double input from the central, state and local governments to develop information technology based on the development at three levels of sub-national, provincial, and municipal agro-information centres. That is, the development and construction of the Sub-Centre of AGRIS in northeast China should be strengthened and centralized to promote the establishment of agro-information businesses in different provinces or cities. The regional sub-national centres and provincial centres should gradually replace their manual and off-line searching with online searching. In regional branches, we should establish an information search system based on microcomputers combined with high-density memory technology. We also can purchase high-capacity microcomputers to create conditions to use online searching and data processing. We should allow the initiative and independent character of local information units to come into full play under the macro control of the central government. Online searching and off-line processing will contribute over time to solving the problems of unreliable communication lines, difficult long-distance dialing, slow transmission speed and high maintenance cost. As our agro-computer search system is still under development, it's impossible to eliminate manual searching completely even when the regional centres use their computer search system widely. Therefore, we have to face the facts that computer searching, CD-ROM technology and hard copy reference books will exist and develop in coordination to make up for each other's deficiencies. This developmental line of different systems being mutually complementary will not only cost us less funds than that of establishing a large-scale online network system, but also will benefit us quickly and this is the developing trend of information technology at the level of regional or provincial agro-scientific information centres. On the other hand, the organization of local networks, the coordination and organization of collecting and processing the documents published locally should be emphasized in the construction of regional or provincial retrieval systems.

2. As mentioned above, no matter what kind of technology we are going to adopt, we should have our own database first, which is the foundation for realizing online retrieval. Without a database with a certain capacity, the advantages of online retrieval can't be fully realized. As the regional AGRIS Sub-centre in northeast China, we will initially participate in the construction of the agro-database organized by the National AGRIS Centre in China before the national comprehensive agro-database is set up. At the same time we'll try our best to use databases abroad. It is also important to set up some specific databases locally to provide search services as soon as possible. Additionally the AGRIS Sub-centre in northeast China should provide English bibliographies or abstracts of local agro-literature to the National AGRIS Centre in China and participate in the construction of comprehensive databases, it should also do information retrieval by computer system in combination with timely manual searching.

Moreover, in the Comprehensive Database established by the National AGRIS Centre, because most of the information comes from serials or books and owing to the shortage of funds, there are a considerable number of valuable articles published in other publications or non-publications. If all this valuable information is not input into the Comprehensive Database, the quality and effectiveness of literature retrieval will be influenced to some extent. Therefore, we should expand our range of literature collection and identification. The Regional Centres can coordinate the provincial centres in the pre-treatment of literature such as screening and processing, under support from the National Centre to build sub-databases to the Comprehensive National Database.

In order to speed up the creation of databases, the regional branch centres should organize training courses and the National AGRIS Centre should send teachers to train qualified indexing personnel for local agro-information units as a way to increase the capacity for literature identification, collection and processing. In this way, we not only get staff members trained, but speed up the construction of databases, which will also be helpful to future computer retrieval.

3. In regional branches, IBM PS/2-50 microcomputers are commonly used. The size of the floppy disks we use is 3.5 inch. But the most popular size of floppy disks outside of our region is 5.25 inches. Because of undeveloped transmission technology, it is hard to form a computer net with different sizes of floppy disks. Because of the increasing volume of data, the facilities in regional centres can't meet the needs of storage and treatment of a large amount of information. It's difficult for AGRIS sub-national centres to undertake searches in the future. It's suggested that the storage capacity and capabilities of our hardware systems in the regional centres should be enlarged in order to provide initiative and multi-directional services.

Second, the synchronous work of the construction of databases and the development of information technology lines is to train information users, which is painstaking work for sub-national centres. Whether or not a database can be effectively utilized depends to a large extent on the users' ability for using an information search system which is quite apart from database quality and reasonable costs. So to improve or perfect the facilities available and to strengthen social information consciousness is a major promise of the completion of the databases and the flexible utilization of them.

Cybernetic Analysis of Scientific Information Services for Agricultural Development in China

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Abstract

Agricultural science information services often do not produce the response desired by information agencies. Reasons for the failure of the information service are partly problems in the information transfer process by information departments. This article briefly introduces the agricultural science information system in China and suggests that the cybernetic approach may partially settle these problems. The knowledge of systems analysis could sensitize information departments to a variety of factors such as the dynamic nature of the agricultural science information transfer process and the fact that the process is interactive rather than unidirectional. Information departments should often analyze their audience, set clear strategies, regularly and systematically gather feedback and evaluate the impact survey and actively modify future activities to orient information services to users' needs. The application of these theories could increase the effectiveness of agricultural information service in China.

INTRODUCTION

Agriculture is the principal occupation of over four-fifths of China's working people. With only 7.3% of the total arable land area but almost a quarter of the total population in the world, China manages to be nearly self-sufficient in food production.

Since 1978 the most dramatic changes have been in rural areas where a drive to virtual de-collectivization has taken place with profound direct effects on the million rural dwellers. Many of the most striking changes in the countryside have been at the micro-level, especially with the rapid spread of the production responsibility system. This system creates inherent economic incentives and greatly stimulates the producer's enthusiasm. It has also inspired farmers to master more advanced agricultural technology for rural development. Agricultural production has risen by almost 8% annually, and rural incomes have more than doubled since 1981. The proportion of rural poverty has dropped from 31% in 1979 to 6% in 1986. Hunger has essentially been banished (Wittwer, 1987).

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Like most areas of the developing world, China's quantity of land available for agriculture is declining. Although the development of village and township enterprises and rural social services have created employment in various ways, the extent of rural underemployment has become more evident. It was estimated that 32.3% of China's rural work force was in surplus in 1982 (Taylor, 1988). An expanded labor force, given a fixed land supply, is unlikely to yield a substantial increase in production relative to its cost. Thus neither land nor labor increase are likely to boost agricultural production. Most observers turn to technological improvements as the most promising path to agricultural growth.

Changes in material inputs, complementary farming techniques, storage technology, and research, supply, and marketing institutions are all parts of the technological transformations (Hornik, 1988). A continuous stream of new technical knowledge and a flow of industrial inputs in which the new knowledge is embodied represents a necessary condition for modern agricultural development (Hayami and Ruttan, 1971). Agricultural science and technology are playing an increasing role in accelerating economic growth and rural development. From 1970 to 1980 about a 27% increase in total agricultural output is credited to scientific and technological improvement. During the sixth Five-Year Plan, the contribution rate of agricultural innovation to total agricultural increase reached 35% (Lu, 1988). The effective integration of these factors, it is argued, is tied closely to adequate information flow.

Agricultural research institutions and universities are major information sources of agricultural science and technology. These institutions produce and disseminate research findings to researchers, extension workers and farmers. Although the production responsibility system has greatly inspired the demand for information about the utility of research findings from these institutions, little attention has been given to examine and analyze the scientific information service for agricultural development. This paper will first introduce China's agricultural science information system, then analyze the information service by the cybernetic approach, and finally discuss improvement options.

AGRICULTURAL SCIENCE INFORMATION SYSTEM AND ITS SERVICE

The agricultural science information system in China is established according to the agricultural research system. Beginning in 1957, the information system has now developed into a relatively complete and multi-level network. The system consists of the Sciencetech Documentation and Information Centre of the Chinese Academy of Agricultural Sciences (CAAS), which acts as a national agricultural science information centre, information departments of affiliated institutions of the Ministry of Agriculture, information institutes or departments of provincial academies of agricultural sciences, information departments of research institutes under CAAS and the Chinese Academy of Fishery Sciences (CAFS) and of agricultural universities and colleges, and agricultural information stations (offices) at prefecture and county level (Figure 1).

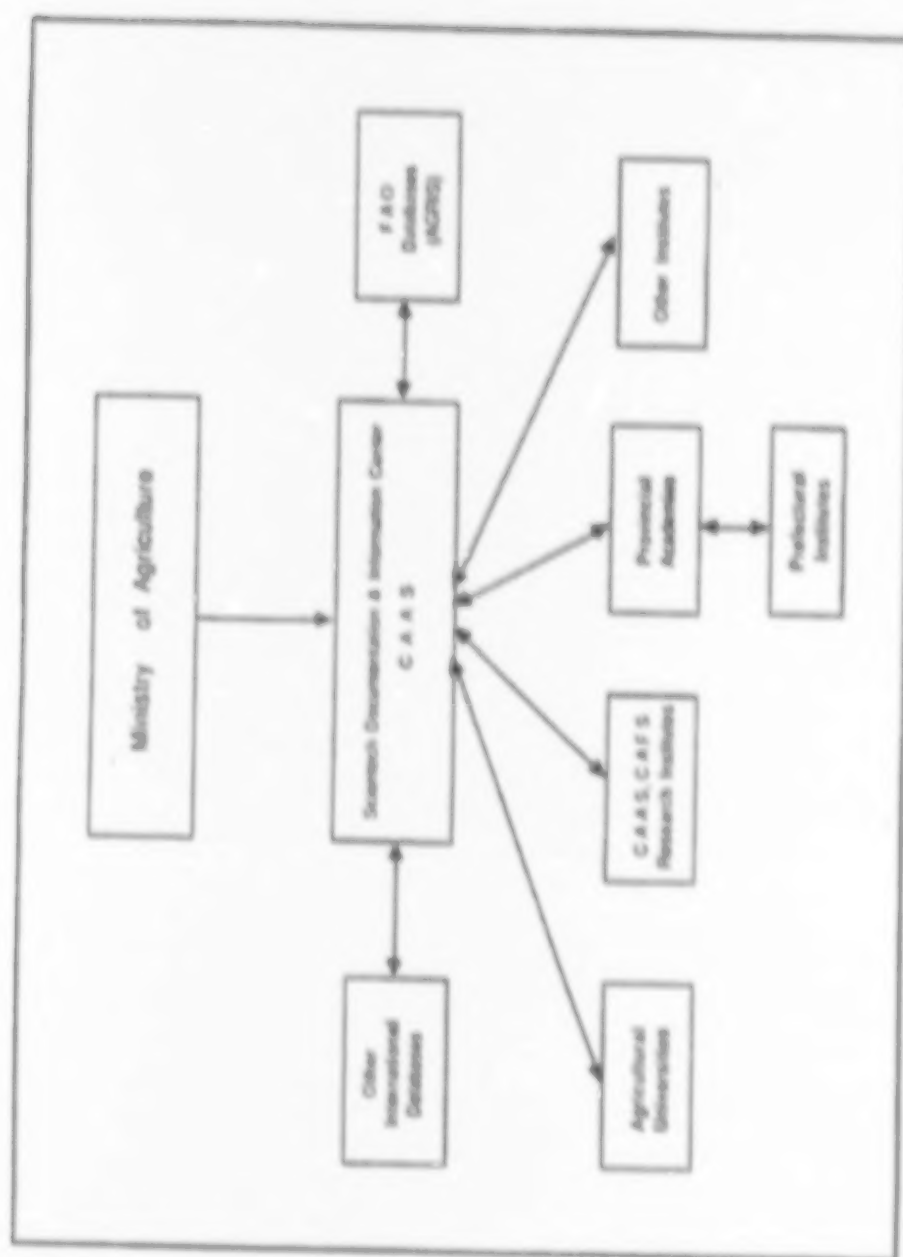


Figure 1 Organizational Setup of Agricultural Science Information System in China

These information departments have functioned well at different levels. The Sciencetech Documentation and Information Centre (formerly the Sciencetech Information Institute) of CAAS has made great achievements in organizing and coordinating the national activities on agricultural scientific information, in analyzing the development and progress of agricultural science and technology and production at home and abroad, in special subject information research on strategies for agricultural development, in providing information for key research projects and administrative decision making, in training information specialists, and in information exchange with foreign institutions. Information departments of research institutes under CAAS and CAFS, and provincial academies have established many documentation collection and information services with specialty and locality characteristics. Focusing on strategies for agricultural development and key research projects in local areas and research fields, they have actively provided quality information service. Information departments of agricultural universities and colleges serve teaching, research and technology extension, and translate and produce information materials.

Besides, agricultural scientific information networks have been established in different research fields, disciplines and levels. The networks have effectively organized technical communication, promoted research achievements, investigated special subject information, and disseminated the information through network publications.

With the spread and perfecting of the production responsibility system in rural areas, more and more farmers are eager to seek technology as well as marketing information. Many information networks at the grassroots levels have been formed with a total staff of 60,000 throughout the country. They collect, analyze and disseminate production and marketing information, which surely accelerates the technology diffusion process from research institutions to end-users of different levels and categories.

In order to effectively disseminate agricultural scientific information, many information journals have been published. In 1985 there were 56 information journals (two indexing journals, 26 abstract journals, 27 reporting journals, and one special subject information research journal), in which two indexing journals—*Bibliographies of Chinese Agricultural Science and Technology* and *Bibliographies of Foreign Agricultural Science and Technology* reported on about 70,000 documents, 26 abstract journals included about 35,629 abstracts, the reporting journals published 5,000 papers, and the information research journal systematically reported achievements of information research projects.

The information departments of agricultural research institutes also produce more than 2,000 kinds of periodical and non-periodical information materials for internal information exchange, such as selective subjects abstracts or bibliographies, collections of research achievements, proceedings, translations, newsletters, etc. According to national economic development and local agricultural research and production, they compiled and wrote many comprehensive and special topic literature reviews and information research reports. These information materials have played such roles as "ear" and "bridge" for agricultural production, research and education.

Agricultural research institutes and universities also publish journals and magazines to disseminate their research findings to scientists, extension workers and farmers. These publications are also channels for them to receive feedback about research findings and publications, which helps future research and publication planning. These publications include learned journals, professional journals, specialized journals and farmer magazines. They have played an essential role in the diffusion of farming innovations to farmers. The lack of extension workers in rural areas has been an obstacle for technology diffusion. It was reported that there were 6.6 agricultural technicians per 10,000 farmers. These publications can partly bridge the communication gap between research institutions and farmers. There are about 400 kinds of agricultural journals and magazines in China. About 2.1 million copies of agricultural journals and magazines were distributed in 1985 (He, 1987).

In recent years, agricultural science information services have been extended in many ways. They provided strategic information for decision-making and planning departments to determine policies of agricultural science and technology, to select technological solutions, and to plan research projects. They also systematically translated articles about and introduced foreign agricultural innovations, new materials and equipment to accelerate agricultural research and production in China. Many projects on special subject information research have been conducted. These projects usually analyze the progress and experience of special subjects in agriculture and propose development strategies in China.

Information departments provide such services as document circulation, information consultation, user training, conducting agricultural technology exhibitions and technology markets, and serving agricultural scientists with document searching, acquiring, training, photocopying and delivering, which economize research time and resources to speed up the research process.

New information technology has been introduced into the agricultural science information system in China. Computer information retrieval has been provided for searching abstracts and bibliographies on such tapes as CABI, AGRICOLA, and AGRIS. New research efforts are being made to store and retrieve agricultural information in the Chinese language with computers. With the support of IDRC, seven regional information centres have been set up.

CYBERNETIC ANALYSIS OF AGRICULTURAL SCIENCE INFORMATION SERVICES

Agricultural research institutes and universities in China are in the business of development-oriented agricultural research. Scientists have in the past decades done much in developing agricultural production and science. However, they have also been criticized for failing to address the needs of farmers and for failing to study the impact of their work on agricultural development. About one third of the agricultural innovations developed have not been accepted by farmers (*China Statistics Yearbook*, 1986).

A farmer's failure to adopt specific innovations in farming is often attributed totally to the farmer's resistance to accept change, or to ineffective extension, or to expensive inputs. However, as various studies have shown, the failure to adopt the recommended technology on the part of peasants is more often the result of institutional and structural factors such as price, market and land distribution. And it may also be, up to a certain degree, the result of the inappropriateness of the technology itself to the farmer's needs and preferences. Many researchers in rural communication (Esman, 1974; Fett, 1972; Huellock, 1971 and Rogers, 1983) have pointed out that one of the factors that most contributes to these situations is the information transfer process itself. Most of this process has been one-way communication, allowing almost no feedback from clientele (extension workers, farmers). In the one-way communication transaction, where the information is from scientists to clientele. The communication strategy has been based on the assumption that scientists know exactly what the clientele needs.

An important factor, pertinent to the development of successful agricultural innovation, is thus the clientele's feedback about farming innovations and their own problems. These messages have to be examined, analyzed and incorporated into the process of developing new technology if they are to be acceptable to situational needs. Information departments of agricultural research institutions should not just work for the production and distribution of agricultural information, but serve a communication function where contact with clients provides the opportunities to obtain feedback about research information and the impact of information services. This paper suggests the cybernetic approach to study the agricultural science information service in China.

Cybernetics is the study of the feedback loop as a basic mechanism underlying system regulation and control. Wiener (1961) defined it as "the science of control and communication." Control is made possible by the process of communicating information between the various components of a system. One component, the control centre, will transmit information to another, with the goal of producing a desired change in the on-going behavior of the latter object. The second component will then transmit information back to the control centre, indicating that the information has been received and providing data for the need of additional messages to produce the desired response by that component.

Buckley (1967) distinguished five necessary stages in the process of control for any cybernetic system (Figure 2). They are:

1. A control centre establishes certain desired goal parameters and the means by which they may be attained;
2. These goal decisions are transformed by administrative bodies into action outputs, which result in certain effects on the state of the system and its environment;
3. Information about these is recorded and fed back to the control centre;

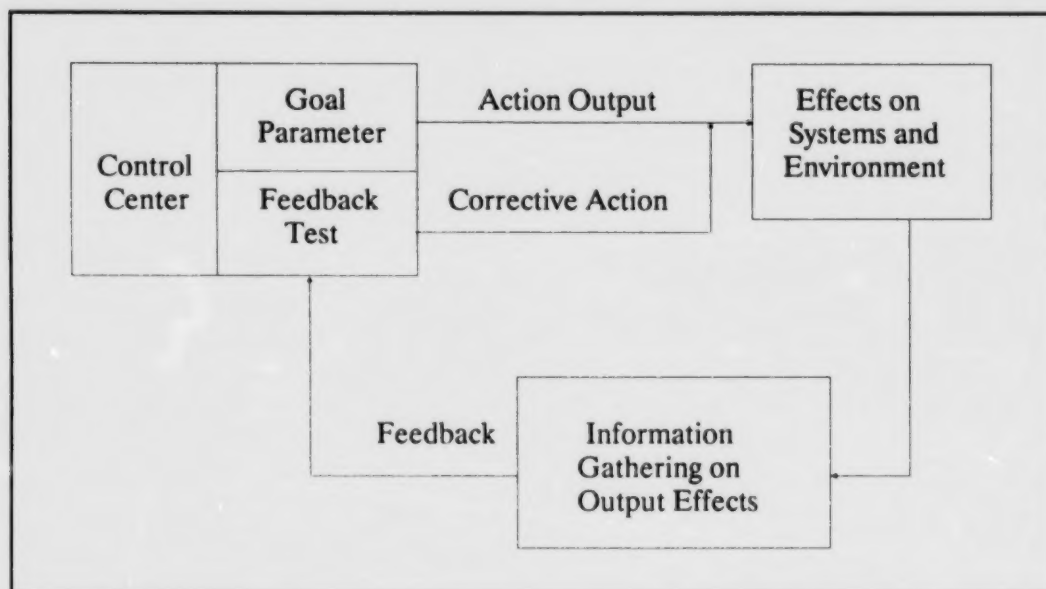


Figure 2. Graphic Representation of the Cybernetic Process

4. The latter tests this new state of the system against the desired goal parameters to measure the error or deviation of the initial output response; and
5. If the error leaves the system outside the limits set by the goal parameters, corrective output action is taken by the control centre.

If the cybernetic approach to agricultural information service is adopted, information departments should act as control centres using information gathered about information users and their environment to reduce errors in information services. These errors may be actual mistakes in information materials or such things as misperceptions of user characteristics and their perceptions of the usability of information materials.

User Analysis

User analysis is the process in which one finds out as much as possible about users of the information service. Basically, we must ask, "Who are they?" The reason why one wants to study the users is that the possibility of perfect communication is zero. However, by proper analysis we can maximize the fidelity of the information exchange.

In communication theory, it is generally recognized that the more similar two individuals are, the greater the probability for accurate transfer of information. In the language of communication researchers this notion is known as the homophily-heterophily distinction. Accurate communication is always easiest if two individuals are very homophilous with regard to the attributes or characteristics most relevant to the topic under discussion. Thus one way to maximize the fidelity of the information transfer in information service is to have individuals with backgrounds very similar to

the information producers. This is often not simply that the person who has the information is different from the person who does not. An alternative is to determine who the users are and to orient the information to their needs in terms of their particular backgrounds (Barnett, 1979).

Users of agricultural science information services are researchers, extension workers and farmers. Information departments of agricultural research institutions mainly serve researchers at their institutions, and pay less attention to extension workers and farmers. Most of them have not done user analysis in a regular and systematic way, so their information service depends on one-way communication and they receive few responses from the audience. Information departments should analyze the information needs of different categories of their users to orient information services to their needs.

Setting Strategies

Strategy is the plan for structuring the activities of a unit or system to achieve specified goals and objectives within an environment (Cowell, 1986). Why do information departments provide information service? What goals are they designed to meet? Before any actual information service takes place, one should answer the following questions: What information services are currently being used which may meet the stated goals? Is a new information service really necessary? Assuming that the new information service is necessary, use the user analysis of potential audience to determine its level of expertise, the current situation, and the future result of the information service.

The next step is to pretest the information service and get reactions of the intended audience. The information departments should use these preliminary evaluations to make adjustments in text before dissemination. At this point, only the strategy has been defined and the mechanism to reach the goal created. Strategies for information service would generally include clear statements of the goals of the information service, user analysis, an evaluation of the impact and utility of information for the recipient, and the integration of relevant feedback into both institution and department planning.

Most information departments do not use any strategies employing the components of the proposed cybernetic strategy. No strategy is in use that systematically obtains feedback from the users and then incorporates useful results into decision-making and program planning. Little attention has been given to development strategies of information service programs of different disciplines and levels of agricultural science and technology (He, 1987).

Communication by Control Centre

The next stage is for the control centre, information department, to exert influence on the other components of the system in an attempt to achieve the goals. This is always done by the exchange of information. In this case, the exchange takes place through information services. Thus the specific behaviors performed during this stage are collecting, managing and publishing, and distributing information materials to the intended audience.

Information departments have spent much of their resources to collect and manage the information materials published at home and abroad. Because of financial constraints, it is impossible for each department to subscribe to many publications. But there is little cooperation between these departments, or high fees for inter-library loans, which limit the information flow into the institutions. It is vital that they should cooperate with each other to acquire the maximum amount of information for the audience.

An efficient information service also depends on how the information department manages its information materials. Because of technical and financial limits, computers are little used for information management. Much of information retrieval is still done with printed publications and subject cards.

Another element of information output for an information department is publishing research findings. Most publications acquire manuscripts from their own institutes and evaluate them through an internal refereeing system or editorial board, which reduces the external information input into the institution. Some editors can not actively communicate with authors and guide them. These factors extend the time lag between manuscript acceptance and publishing.

Dissemination as an output function for both the information department and the institution, can, through communication, attract feedback regarding the impact of information service and research results. Many information departments receive little feedback about the effectiveness of their services. In China, most journals, magazines and newspapers are subscribed and distributed through post offices; it is difficult for information departments to know exactly who and where their audience is. Most publication programs are supported by special funds of their institutions and subscriptions. These departments produce and disseminate publications based on their own internal priorities and needs and perceptions of readers' needs rather than on those actually expressed by clients. More attention is given to producing publications than to disseminating them. Some agricultural publications are distributed free of charge with less consideration of readers' needs. Recently, subscriptions to most publications have been declining, and 80% of them are in debt (Guan, 1986). Considering the low living standard of farmers, the main objective of these publications should be to increase the social and economic efficiency in rural areas, not to make a profit. So more support should be given to provide agricultural publications at low prices.

Gathering Feedback

The information that is returned to the control centre is called feedback. This information is gathered by the control centre about the effects of the output on the system, i.e., how effective the information service is in meeting the established goals. Positive feedback is information that affects a system so that any change causes further change, which causes a loss in stability in the system. Negative feedback causes a regulatory action that tends to bring the system back to its previous equilibrium. There are several ways to gather feedback. Information departments can engage in on-going and immediate dialog with readers during the information service process. Systematic attention to discretionary feedback from readers and a concerted effort to obtain data through

direct inquiry can produce a similar, mutually acceptable solution and a collective relationship with the users.

In recent years, information departments have provided SDI services mainly for agricultural researchers and have received on-going feedback from them. But for the current awareness service, it is a little difficult for them to get immediate feedback. Although the "letter to the editor" is the most common form of feedback provided at the discretion of the audience, very few institution publications indicate that information users are encouraged to submit comments about the publications and information they contain. Some information departments occasionally enclose a short mail form with publications so readers may conveniently reply to them. However, a very low response has been achieved in this manner. Because most publications are subscribed and distributed through post offices, information departments can not do direct inquiry of readers. This is an area of the information transfer process worthy of future communication research.

Evaluation and Corrective Action by the Control Centre

Evaluation is a process of actively seeking information which relates the actual outcome of an activity to the planned outcome. If the degree of discrepancy from the planned outcome is significant, a corrective action should be taken by the control centre. This enables the information department to modify future activities so that the actual output comes close to the expected. In this sense, evaluation affects the information department cybernetically by providing alternative or supplemental information to whatever feedback is involved.

Because information departments have more control over evaluation than volitional feedback, they should evaluate the impact of the information services by direct inquiry. However, information departments do not perform self-evaluation or do communication research into ways of making information service more effective. Information flows from institution to user are emphasized but seldom evaluated for their effectiveness. Information flows from user to institution are informal and unsystematic. Information service is seldom followed up with an evaluation impact.

DISCUSSION

It is a frequent mistake to assume that information which is available in the literature is available to the users. We forget that this literature must first be located, read and understood before it can be used. Effective information service in this sense depends on presenting the information in a form that is acceptable to the users and which will produce the intended action. We scientists and information specialists should not be satisfied that our work ends when we publish and disseminate a scientific paper, an annual report, or a conference proceedings. All the work, all the money, and all the time spent on research and publishing has been wasted if the publication remains on the shelf unused. It is time for us to investigate the system for producing, disseminating and using agricultural science information and, if necessary, to design new information services that will actively take the needs and feedback of users into consideration.

Agriculture science information services in China have contributed a lot to scholarly communication between agricultural researchers and in technology transfer to extension workers and ultimately to farmers. However, they mainly depend on one-way communication and information-oriented policy to disseminate agricultural science information, and pay inadequate attention to its effectiveness and feedback. Although many social and economic factors affect the agricultural information transfer process, we can still do a lot to improve in this field.

Before beginning any information service program, information departments should analyze their potential audience to maximize the fidelity of information exchange. By analyzing their different sets of past experiences, attitudes, knowledge and values to communication events, we can distinguish and classify their information needs. For agricultural scientists, extension workers and farmers, different information strategies should be applied. National or regional agricultural science information centres should work together to establish databases of current agricultural research projects to reduce repetitious research work and to improve the quality of research. Information departments should provide more services to extension workers and farmers to accelerate the transfer of research findings into agricultural productivity. Besides the printed media, electronic media should be used to stimulate the diffusion of agricultural innovations.

The steep rise in cost of publications and the increasing amount of new documents necessitates appropriate and effective resource sharing. Local institutions can pool their resources and acquire a good amount of literature with a delivery system. Coordination of publishing activities between these departments should be established to produce quality publications and reduce the time lag of publishing. The same attention should be given to information dissemination activities, such as exhibiting at professional meetings, technology markets, collecting and renewing mailing lists. Both user and staff of information services should strive to improve the efficiency of information service. Information departments should take steps to increase the flow of feedback into the system and to seek ways to integrate useful information into program planning and decision-making. Their work should not be restricted to collecting and disseminating agricultural science information, but be involved in problem-solving and the decision-making process by providing strategic information and feedback. A systematic evaluation should be established about the effectiveness of agricultural science information service to modify future activities.

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Functioning of the National Agricultural Information Network (AGRINET)

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Abstract

Resource sharing through networks can make services and materials available to patrons, cut costs, and reduce unnecessary duplication of materials. This paper describes the objectives and the cooperative projects of the Sri Lanka Scientific and Technical Information Network (SLSTINET) and the Agricultural Information Network (AGRINET). Both are being developed jointly by scientific and agricultural libraries and are coordinated by the Natural Resources Energy and Science Authority (NARESA) of Sri Lanka. AGRINET is a subsystem of SLSTINET. The Selective Dissemination of Contents Page (SDCP) Scheme is the most important cooperative activity undertaken by AGRINET. Two databases, the Union Catalogue of Agricultural Periodicals (UNILIST/AGRI) and the "Agricultural User Profile Inventory" (UP/AGRI) are being produced by automated methods. These two databases were used to draw up the SDCP Scheme by creating a user demand file, a periodical demand file, and selecting the donor library for a given periodical. Apart from the SDCP Scheme, the two databases, UNILIST/AGRI and UP/AGRI are tapped to develop resource sharing and resource improvement programs such as: Cooperative Acquisition Plan for agricultural periodicals (CAP/AGRI), agricultural periodical holdings list, directory of agricultural scientists, periodical demand report and subject interest reports. Briefly describes the participation in SAIC (SAARC Agricultural Information Centre) which is a regional cooperative information system and in AGRIS (International Information System for Agricultural Sciences and Technologies), which is the world's largest agricultural bibliographic information system and the only one which is cooperative and international. Describes the cooperation of the Central Library of the Department of Agriculture for AGRINET activities through its participation in AGRIS.

Introduction

Sri Lanka is a small developing country with a population of around 16 million. It is a poor country with a per capita GNP that stood at \$339 in 1985. It has a high literacy rate (around 80 percent) and a relatively well-developed education system.

Data compiled by the Ministry of Plan Implementation for 1984 showed a total of 5,557 qualified natural scientists and technologists in Sri Lanka, of whom 2,951 (53 percent) were engaged in research and development activities. The Scientific and Technological Research System is not very productive, has not been adequately funded, and is

perceived as being in crisis. One aspect of the crisis has been funding. Since 1960, per capita research and development expenditure has declined to 0.14 percent in 1983. There has been continued pressure on library budgets, manifested most dramatically in 1973-75 when the government suspended all foreign purchases by universities including all foreign periodical subscriptions, when faced with high food and energy prices in the world market.

The Sri Lanka STI Library community's response to budgetary pressure was resource sharing. Resource sharing had become the more or less official STI policy after a UNESCO consultancy mission on the setting up of a National Scientific and Technical Documentation Centre in 1968. Even so, the actual implementation of the recommendations for a union list, bibliographies, reproduction capacities, etc., set the Sri Lankan STI agenda for the 1970s and the 1980s. The government of Sri Lanka, on the recommendation of UNESCO, established the Sri Lanka Scientific & Technical Information Centre (SLSTIC) in 1977 as part of the National Science Council (redesignated in 1982 as the Natural Resources, Energy and Scientific Authority (NARESA)). The first edition of the Union List of Scientific and Technological Serials (UNILIST) was issued in 1979. The idea of a voluntary, but semi-official, network of STI libraries was raised at a meeting of the Directors of Scientific Research Institutions in 1977. The membership in this network, since named the Sri Lanka Scientific & Technical Information Network (SLSTINET), had grown from 23 in 1979 to 105 by 1989. Work on rationalizing the purchases of expensive but essential abstracting and indexing journals through a cooperative acquisition plan (i.e., eliminating multiple subscriptions within Sri Lanka) commenced in 1978.

National Networks

SLSTINET

The primary objective of SLSTIC is to promote resource development and resource sharing activities of the country's scientific and technical libraries. SLSTIC has now organized a hundred or more scientific and technical libraries to form a network designated the Sri Lanka Scientific and Technical Information Network (SLSTINET). SLSTIC has inaugurated jointly with the assistance of other libraries, several cooperative projects including:

- UNICAST: Union Catalogue of Scientific & Technical Books in SLSTINET
- Union List of Periodicals in SLSTINET
- Cooperative plan for the acquisition of scientific and technical abstracting journals.

SLSTIC acts as the coordinating center of SLSTINET by providing various services to improve the resources of the libraries. In addition to the above, SLSTIC provides services such as photocopying, document procurement, microfilming services, training services, and consultation services, etc. It also publishes its own newsletter.

SLSTINET continues to function, convening annual meetings of STI libraries, convening committees on standardization and other matters, holding training programs, and maintaining the union catalogues. Its membership has grown to 105, incorporating almost all the STI libraries and documentation centres. SLSTIC serves as the supplier (but more accurately as the locator, since its own holdings are minuscule) of last resort for the domestic inter-library loan system.

With the growth and expansion of SLSTINET activities, four specialized sub-networks were created with the main objective of organizing specific subject-oriented projects. These sub-networks are AGRINET, HELLIS, RERINET, and TECHNINET dealing respectively with agriculture, health sciences, renewable energy, and technology. These sub-networks offer unique services to users in member institutions such as the contents page dissemination service in AGRINET, the offline computerized database search facility in HELLIS, and the building of technology information packages in TECHNINET. They are connected to specialized international STI networks established by international organizations.

AGRINET (National Agricultural Information Network)

AGRINET includes 22 libraries attached to agricultural and allied fields. This network was formed to improve the resource sharing and information transfer activities of the agricultural libraries in Sri Lanka with a view to providing better service to the agricultural scientists and technologists engaged in research and study.

The setting up of an agricultural subsystem is a very timely measure as priority has been given to agricultural information by all the developing countries.

Objectives of AGRINET:

- To improve the agricultural information facilities in Sri Lanka
- To promote exchange and transfer of agricultural information within Sri Lanka
- To work out resource sharing programs
- To assist libraries in the subsystem in staff and resource development activities
- To operate as a subject-oriented subsystem of the Sri Lanka Scientific and Technical Information Network
- To advise the UNISIST National Committee on matters relating to dissemination of agricultural information
- To link with regional and international information systems through SLSTIC.

Functions of AGRINET:

1. Selective Dissemination of Contents Pages (SDCP)

Libraries participating in the Agricultural Information Network (AGRINET) decided to launch a special program to share periodical resources. The most economic and convenient way to disseminate information on articles appearing in current periodicals is to circulate contents pages of the periodicals. A library which receives a large number of agricultural periodicals finds it costly in time, money, and effort to distribute photocopies of contents pages of all periodicals. Since most are not of core interest to users, such a service would lead to resource wastage.

AGRINET libraries decided to distribute contents pages selectively among their users. The Selective Distribution of Contents Pages service would help a user of one library obtain photocopies of contents pages of periodicals received by another library.

SLSTIC compiled a union list by collecting information on current agricultural periodicals acquired by the AGRINET libraries. It was revealed that the 22 cooperating libraries receive 661 titles. The information was entered in the microcomputer at NARESA to create a database named "Union List of Current Agricultural Periodicals" (UNILIST/AGRI).

SLSTIC periodically conducts surveys to evaluate agricultural information needs of users with the help of the AGRINET libraries. Questionnaires from 293 agricultural information users were collected in 1989. A database entitled "Agricultural User Profile Inventory" (UP/AGRI) was created using the data collected from the user survey.

The two databases, UNILIST/AGRI and UP/AGRI were used to draw up the SDCP Scheme in the following manner:

1. The creation of a "User Demand File" by analyzing the profile inventory (UP/AGRI) and extracting relevant data from the Union List (UNILIST/AGRI). A record in the User Demand File contains the user code (which identifies the user), periodical code, and holding libraries:

DAG	/22017	CRI, PGIA
(User Code)	(Periodical Code)	(Holding Libraries)

No record is made if the periodical demanded by a user is available in his or her library. A tag was introduced in the records of the union list to indicate that the periodical has no contents page. Hence, it was possible to prevent entering such periodicals in the User Demand File.

2. The records are sorted by periodical code and used to create the "Periodical Demand File." A record of this file contains the following information:

017	DAG/22 NARA/11 RRI/02	CRI, PGIA
(Periodical Code)	(Users)	(Holding Libraries)

3. Selection of the donor library for a given periodical is made by computer. If the periodical is acquired by only one library, then automatically it becomes the donor library. If more than one library receives the periodical, the library which has been assigned the lowest number of periodicals is selected as the donor. This procedure was adopted to distribute the burden of photocopying evenly among libraries.

017	DAG/22 NARA/11 RRI/02	CRI, PGIA
(Periodical Code)	(Users)	(Donor)

AGRINET's procedure for implementation of the SDCP Scheme:

1. The donor library, when it receives a SDCP title (i.e., a periodical assigned to it), should send a photocopy of the contents page to SLSTIC. Thus the donor library is burdened with only one photocopy per issue.
2. SLSTIC identifies the user libraries which need the contents page, duplicates it, and sends the copies to the user libraries. (SLSTIC does not send contents pages directly to the user.)
3. The user library which receives the contents page sends the contents page to the user. If there is more than one user, duplication will be done by the library concerned.
4. A user who wishes to obtain an article makes a request to his or her library. This library locates another which holds the periodical (by consulting the Union List) and initiates an inter-library loan request.
5. SLSTIC distributes reports showing the progress of the SDCP Scheme periodically among the AGRINET libraries.
6. Progress of the Scheme is reviewed at AGRINET meetings.

Apart from the SDCP Scheme, the two databases, UNILIST/AGRI and UP/AGRI, are tapped to develop resource sharing and resource improvement programs.

2. Cooperative Acquisition Plan for Agricultural Periodicals (CAP/AGRI)

Since the Union List shows the degree of duplication of a title in AGRINET, it is possible for libraries to identify the periodicals that could be dropped from their list of acquisitions. Libraries are requested to name the titles which they will continue to acquire even at a very high cost. These titles are labelled "Core Journals" for the library concerned. Indication of core journals ensures prevention of dropping a title by all libraries.

3. Agricultural Periodicals Holdings List

Each library is supplied with a list of periodicals held by that library.

4. Directory of Agricultural Scientists

A directory giving detailed information about scientists and technologists engaged in study and research in agriculture and allied fields is compiled using the Profile Inventory (UP/AGRI). Librarians can use the directory as a tool for "Contact Services." Additionally, users can contact other scientists engaged in research in fields similar to their own fields of study and interest.

5. Periodicals Demand Report

The Periodicals Demand Report indicates the demand made for a periodical by information users of AGRINET libraries. The Demand Report also proves useful when a library reviews its periodicals acquisition policy. A library, recognizing the fact that its periodicals are useful to the entire network, may drop a title which is in low demand and retain a title which is in high demand.

6. Subject Interest Report

The Subject Interest Report shows demand for information on a particular subject by agricultural information users. The Profile Inventory is analyzed to find the demand for subjects. The Subject Interest Report is useful to identify the areas of specialization of libraries. Also, it guides a library in building up its collection according to the needs of its users.

Participation in Regional Agricultural Networks

SAARC Agricultural Information Centre (SAIC)

The SAARC Agricultural Information Centre is the recent creation of a regional agricultural documentation centre under the auspices of the SAARC. SAIC makes efforts in improving networking among agricultural library and information centres in the region. SAIC's objective is to create a South Asian Agricultural Information Network that would make the rich information resources in these countries more easily and widely accessible to users in and outside the region.

The Central Library of the Department of Agriculture has been designated as SAIC National Focal Point for Sri Lanka by the Governing Board (G.B.) of SAIC and the Technical Committee on Agriculture (TCA).

The SAIC National Focal Point will be responsible for collecting, compiling, processing, and updating information at the national level with the guidance and assistance of SAIC, which in turn will handle the overall key data and make them available to each member country. The system will function according to a common methodology developed and controlled by SAIC and publications will be issued and distributed to each country through national focal points.

As a preliminary step, action has been taken to compile a Directory of Agricultural Institutions in the SAARC region. This project has been undertaken by SAIC on a priority basis as recommended by the SAIC Governing Board and the Technical Committee on Agriculture respectively.

Participation in International Agricultural Networks

AGRIS

The Central Library of the Department of Agriculture acts as the National Centre for the International Information System for Agricultural Sciences and Technologies (AGRIS). This project is executed by the Department of Agriculture with grant support from IDRC. The project commenced in 1982 and the first phase terminated in 1986.

Its primary objective is to establish a National Agricultural Information Service in which the Central Library will act as a focal point allowing it to function as the National Resource and Referral Centre for Agricultural Information.

The specific objectives of the project are:

1. To capture the agriculture literature being generated in institutions throughout Sri Lanka
2. To input records of these documents to AGRIS
3. To produce a National Agricultural Bibliography
4. To provide services of retrospective searching, current awareness, and SDI (Selective Dissemination of Information)
5. To provide a document delivery service on request.

The AGRIS Project is an important development for agricultural information in Sri Lanka. From its inception in January 1982 to the present time, this project has made excellent progress in taking AGRIS to the scientists of Sri Lanka and participating in the system. The majority of the users of AGRIS are scientists who are users of

AGRINET libraries. However, since the project conclusion in 1986, a lack of funds at the Central Library has forced it to significantly curtail its services.

In order to further strengthen agricultural information services with special reference to AGRIS and CARIS projects the Central Library submitted a new proposal to IDRC in 1989. It is appreciated that IDRC has readily agreed to fund this new project commencing in 1991. The Central Library has been requested to take over the coordination of AGRINET activities which is presently handled by NARESA with this proposed project coming into effect in 1991.

As IDRC has suggested, being the National Focal Point for AGRIS, coordination of AGRINET by the Central Library will definitely assist in the rationalization and sharing of the country's agricultural literature in a more efficient manner, and will enable the scientific community of Sri Lanka to benefit from, as well as contribute to, the latest agricultural research.

References

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USER PROFILE			
Name of Library	Number of Users	Number of Journal Titles	SDCP Titles Assigned
ARTI	10	18	11
CISIR	17	44	22
CRI	17	75	33
DAG	128	65	27
DF	4	28	21
DI	2	6	5
IIMI	6	43	20
MADR	-	3	1
MASL	-	1	1
NARA	8	11	7
PGIA	22	112	54
RRI	13	73	33
SRI	6	-	-
TRI	24	101	32
UB	12	1	1
UR	8	57	33
VRI	12	18	7
WRB	4	5	4

ARTI Agrarian Research & Training Institute
 CISIR Ceylon Institute of Scientific & Industrial Research
 CRI Coconut Research Institute
 DAG Department of Agriculture
 DF Department of Forestry
 DI Department of Irrigation
 IIMI International Irrigation Management Institute
 MADR Ministry of Agricultural Development and Research
 MASL Mahaweli Authority of Sri Lanka
 NARA National Aquatic Resources Agency
 PGIA Postgraduate Institute of Agriculture
 RRI Rubber Research Institute
 SRI Sugar Research Institute
 TRI Tea Research Institute
 UB University of Batticaloe
 UR University of Ruhuna
 VRI Veterinary Research Institute
 WRB Water Resources Board

NEED LIST	
Name of Library	Number of Journal Titles Needed for Scientists
ARTI	20
CISIR	46
CRI	51
DAG	201
DF	19
DI	8
IIMI	15
MADR	27
MASL	-
NARA	-
PGIA	78
RRI	49
SRI	29
TRI	73
UB	54
UR	35
VRI	36
WRB	17

ARTI	Agrarian Research & Training Institute
CISIR	Ceylon Institute of Scientific & Industrial Research
CRI	Coconut Research Institute
DAG	Department of Agriculture
DF	Department of Forestry
DI	Department of Irrigation
IIMI	International Irrigation Management Institute
MADR	Ministry of Agricultural Development and Research
MASL	Mahaweli Authority of Sri Lanka
NARA	National Aquatic Resources Agency
PGIA	Postgraduate Institute of Agriculture
RRI	Rubber Research Institute
SRI	Sugar Research Institute
TRI	Tea Research Institute
UB	University of Batticaloe
UR	University of Ruhuna
VRI	Veterinary Research Institute
WRB	Water Resources Board

Agricultural Information Services of Hupei Province

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Abstract

Hubei is a large agricultural province in China. In order to live up to its geographical superiority and promote the development of an agricultural economy, it is necessary to provide good information services in agriculture. The major experiences are: To pay close attention to new technologies and provide information services for our leaders in their decision-making; to establish close contact with groups in various research subjects and serve the agricultural scientists and researchers; to provide information services mainly by writing review articles which are directly helpful in solving the key problems in agricultural production; to report technical news quickly and serve the farmers; and to go to agricultural areas and provide information services to selected local farms.

Agricultural information work should serve to advance agricultural production and research. The information specialists and librarians must build up this standpoint in their minds, then they will be able to keep this direction in hand and bring our initiative into full play to obtain worthwhile social and economic benefits.

The territory of China is very extensive. The climates are different in various districts, and there are many kinds of crops. In the agricultural information service system, it is very important to build an agricultural information agency at the province level which will maintain local characteristics, in addition to establishing a National Agricultural Information Centre in China.

Hubei Province is situated in the middle reaches of the Yangtze River. Its climate is warm, rainfall is abundant, and the soil is rich. It is called the "Thousand Lakes' province, Fish and Rice's land." There are 50,500,000 people in the whole province. Of them, 39,000,000 live and work in the countryside which amounts to about 78% of the total population. It has 185,900 square km of land. In 1988, the cultivated area was 3,491,800 hectares; the growing area of food crops (include multiple cropping) was 5,087,830 ha., and its grain production was 22,526,500 tons. The growing area of cotton was 440,790 ha., which yielded 362,000 tons. The water area which can raise fish is 618,660 ha. Hubei is an important productive base of grain, cotton, fish and pork in China. As a major agricultural province, Hubei must have a relevant agricultural information agency to conduct information services to live up to its geographical superiority, and promote the development of the agricultural economy.

We had an information service office in the early 1960s and established a scientific-technical information institute in 1987. There are now more than thirty information specialists. The institute provides information services in various ways.

It is a prerequisite of information services to define the information user. Our major users are: the agricultural policy makers, the agricultural scientists and technicians, persons who are responsible for extending the techniques, the farmers and managers. We are committed to progress in providing them services.

I. Information on New Techniques Is Available to Leaders and Serves Them in Their Decision-Making

The leaders at all levels have the function of decision-making. Correct decision-making depends on the sharing of scientific knowledge. It is no exception for making agricultural technical policy. It usually effects the bumper-harvest or failure of agricultural production when a technical decision is right or wrong. Agricultural information organization must actively provide new technical information to the leaders and give them useful help in their decision making.

For example, we received news of the new cotton strain "72-22-28" which was bred by Shayang Farm from a material information conference in Feb. 1981. But because differing viewpoints existed for the new variety, we made an investigation on it after the meeting and have found that the new strain is really beneficial and its production has increased by 30% on 31 experiment stations over three years, compared with the variety "E-guang." This was a valuable piece of scientific-technical information, and we reported it on the front page of the journal *Agricultural Scientific-Technical Information* (No. 4, 1981) which was edited by our Institute. This strain was identified by the scientific-technical commission of Hubei province in September who named it "E-Sha 28." We reported the appraisal news on the front page of the same journal again in issue 10, and introduced its main characteristics in order to attract leaders. Thereafter, the provincial government decided to extend the new variety of "E-Sha 28" in order to increase cotton production in 1982. This variety became the master cultivar within a few years and its growing area reached 340,000 ha. in 1986.

Our experience has shown that once leaders attach great importance to technical information, it can produce much economic benefit. This demonstrates the broad prospects of agricultural information in serving leaders in their decision-making. Policy-makers need a great deal of technical information for developing agriculture, particularly strategic information. Information specialists must have regular close contact with the leading body and know their information needs in time, then they can actively conduct their activities. But this is difficult for the information agency to accomplish. Currently, we are facing competition from the soft sciences and have trouble there, too. Therefore, the following points should be paid more attention to in providing information services in this respect: first, concentrate on the program; second, do it according to one's capability; third, hard work will yield remarkable success.

II. Watch Out For Trends in Using New Techniques and Serve the Agricultural Scientists and Technicians

Agricultural scientists and technicians are the middle link and principal force for extending agricultural techniques. It is the traditional profession of an agricultural information organization to serve scientific-technical researchers. We have adopted the following measures in offering our services:

(1) Established close contact with the major research groups and provided SDI services. According to their needs, we provide some editorial services, such as literature bibliographies, abstracts, and so on.

"Studies of Exploitation and Utilization of Hubei Photoperiod Sensitive Genic Male-Sterile Rice" is a priority project of our province. Both our institute and our users signed a contract of specific service in 1985. We supplied 721 bibliographies of literature in Chinese and foreign languages and wrote articles such as "The New Development of Male-sterile Heterosis Utilization and Research of Crops," "The New Tentative Idea of Using Male-sterile in Carrying out Recurrent Selection and Colonial Improved Breeding," etc., for them.

In the studies of "Conveyable Technique of Three Crops Rotation Systems in Middle China," we supplied information on the new advances on "Water-dryland Rotation," "Mineral Nutrition and Fertilizer Management of Rice," "Nitrogen Fertility and Fertilizer Management of Wetland Rice," etc., to agricultural scientists. This information provided by us gave beneficial references to researchers in grasping the recent developments of science and technology, working out a research plan and an analytic technique of rotational soil, impelling the project to reach an advanced level domestically and obtaining the first prize for technical improvement given by the Chinese Agricultural Ministry. Three provinces in middle-China have extended the three-crop rotation system by 2,700,000 ha. and gained remarkable social and economic benefits in recent years.

We have supplied timely information on "Research Progress of the Utilization of Ratooning Rice," "Rice Ratooning" and more than 200 bibliographies of the literature of ratooning rice in the breeding process. These information materials have not only played a guiding role in breeding ratooning rice for high and stable yields, but also provided the scientific basis for formulating the cultivation technique measures for high yields of ratooning rice. It enabled "40-1" to be extended by 5,400 ha. within two years and achieved good results by saving labor, reducing the cost of consumption and increasing yield.

(2) Aimed at the crucial technical problem of agricultural production in providing information services mainly by writing reviews. We wrote and translated articles titled "The Effect of Temperature on the Development and Production of Rice," "The Progress of the Fertilizing Technique in Rice Research," "The Progress of High Yields Studies of Crops," "The Research Tendency of Bioengineering in Rice Breeding," etc.,

a total of about fifty articles since 1980. The articles were published in the technical press and provided new trends and experiences in agricultural scientific-technical development to users who do the extension work.

III. Providing Information on Practical Techniques to Farmers and Agricultural Managers

Agricultural information has brought great changes to the rural economy and agricultural production through reforms in ten years. Hundreds of millions of farmers are not only the producers, but have also become relatively independent managers. As producers, farmers need techniques on growing for increasing yields; as managers, they also need information on marketing to reduce costs and increase benefits. These needs, especially for information on techniques for growing and feeding economic animals and plants and processing agricultural products, are difficult to be met by the technique-extension station alone. Therefore these users need the information service from our institute and we should try our best to meet their information needs.

Appropriate methods of service should be used in order to meet new information needs. We have adopted the following measures:

- (1) Report practical and technical information promptly to the farmers. This method was easy to implement and produced quick results. We compiled a title list of more than 750 articles and farmers purchased this material by mail. In this way, the information organization can serve the farmers directly.
- (2) Go to the countryside to serve selected districts. We assign technicians to the countryside to serve the farmers directly and help the farmers become profitable. They not only transmitted scientific-technical information, but also taught farmers the cultivation techniques of the specific crops to farmers.

Shen-Nong-Jia forest region is the greatest natural protection area in our province. It teems with Chinese herbal medicine. Because existing information was inadequate, and production techniques were lagging behind, the herbal medicinal resources couldn't be exploited effectively; therefore, the farmers lived in poverty. We assigned technicians and staff to this area and in 1986-1987 provided technical information service on Chinese herbal medicine to them. We put forward a suggestion for developing the rhizome of Chinese goldthread (*Coptis chinensis*), and the bulb of fritillary (*Fritillaria thunbergii*) based on our research. The local government paid more attention to this suggestion and convened a specific meeting of the village and town's governors to discuss the production of these two rare medicinal herbs and drafted the developing plan and practice. Thereafter they conducted three technical training courses. More than 300 people attended the courses. This work played an important role in their production of medicinal herbs.

Villages are the principal markets for agricultural information. Farmers are the basic users. We must study the new problems and find more effective methods of information

service in order to promote the rural economy and agricultural production more quickly.

Some Ideas on the Tendencies of Information Services by the Regional Information Agencies of Agricultural Science and Technology

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Abstract

For most local and regional information agencies of agricultural science and technology, their activities ought to avoid only serving scientific research, and their emphasis ought to lean toward technological information services, so as to provide agrotechnical information services to rural areas, farmers, and personnel and agencies of agrotechnical instruction. Based on some actual situations in Sichuan Province, the most populous province of China, some strategies are pointed out in the field of technological information services.

1. The services of local and regional information agencies of agricultural science and technology in China

The focus of information service has been directed toward scientific research in agriculture for a long period of time. When investigating the present situation of most regional information authorities for agricultural science and technology, the following objective realities were easy to discover: no information authority in agricultural science and technology can escape its major role of serving scientific research, and most of them agree that information in agricultural science and technology is aimed at serving both scientific research and also the strategic decision-making of China's leaders. Although most of them recognize the important role of providing technological information services to promote agricultural production and the development of the rural economy, they appear weak and ineffective in providing these services due to the limitations of the fundamental premise that information authorities should serve scientific research, etc. Many facts such as those described below may be seen: many information users, especially rural users and farmers experience an information deficiency over a long period of time even though many references are collected by the information agencies year after year, and many highly skilled personnel work hard to collect, sort and report the references, however, the capabilities of the information services have not been fully realized, and its status and role has not been recognized and given attention by society. Most achievements in agricultural study cannot be utilized even if they were to emerge in an endless stream. All of these show, to a great degree, that the technological intelligence service is very weak and there is a great difference between the need for economic construction and the present key services of the information agencies. From this point of view, we may observe that this situation

is imperilling the existing value of local and regional intelligence agencies in agricultural science and technology.

In recent years, some information agencies of agricultural science and technology have explored the content and methods of information transmission and its utilization based on the needs of agricultural production and rural economic development in their own regions. Meanwhile, significant social and economic effects have been felt in services to support agricultural scientific research. We see that aspects of the gradually formed focal points of reference collection and provision, the structure of fundamental work and staffing, as well as the general features of information authorities, indicate that the function of information is mainly to serve scientific research.

Nowadays, almost all collected data in information agencies of agricultural science and technology are references in the field of agricultural science and technology, and the patents, samples and data of actual techniques are very deficient. Even the amount of agricultural science and technology periodicals, which are the most important transmission tools in China, is less than that of other countries. For example, the percentage of periodicals in science and technology as a whole is 19% in developed countries, 20% in India but only 11.6% in China.

For a rather long time, the guiding thought of the periodicals has been to include articles that reflect research. Most of the articles are reports of research and experiments and very few of them are articles on technical applications. This situation has been much improved in recent years. However, when compared with the same sort of periodicals in other countries, there is a considerable gap. The difference in utilization of the information in different regions is very obvious due to the influence of poor communications and postal conditions, as well as because most of the periodicals are bimonthly. From the point of view of serving scientific research there do exist problems of insufficient and excessive function, but from the point of view of services to share techniques, the problem of insufficient function is very serious. According to an investigation and analysis by the Sichuan Information Institute of Science and Technology on the distribution of foreign language journals in 21 reference collections in Sichuan province, foreign language periodicals are very costly and have a large volume, however the utilization ratio is rather low. Based on statistics for 2.5 years, almost nobody reads nearly 40% of the foreign journals in agriculture, this indicates the significant excessive function of the information. On the other hand, 45.53% of prized achievements can't be retrieved in foreign language journals and this reaches 58.4% for computer indexing. The same situation can be seen in foreign agricultural periodicals in the Sichuan Academy of Agricultural Science Library.

In the field of collected Chinese references in agricultural science and technology, the main role of the information is to address subjects and to serve as resources for scientific research. The applied technical references and data in this area are also very poor.

Most staff members of the agricultural science and technology information agencies come from colleges and universities of foreign languages or agriculture. They lack

systematic theoretical learning in information science and lack actual experience in providing information services. They tend to show a preference for providing learned services for scientific research. Therefore, those members who are good at technical information services are insufficient. Thus a staff mind-set that coincides with serving scientific research has been created. In its organizational structure it also shows features of specializing in serving scientific research. The aim of many information authorities is to meet the need of scientific research. Relevant organizations have been set up to provide services in specialized subject areas and identifying foreign language references for scientific research. For a rather long time, however, almost no sectors have especially served the technical information developments in most intelligence agencies. Even in the most recent year's plan and implementation of database construction, the tendency to mainly serve scientific research can also be seen, a fundamental approach that regards references as being superior to data is formed.

In addition, there exists a problem in that the establishment and distribution of local information agencies of agricultural science and technology are felt to be the same as administrative sections. If the overall functions of information agencies are subordinated to administrative sections and scientific authorities, naturally, they will pay a price for sacrificing the superior constitution of information circulation of agricultural science and technology. This violates a principle of net structure with more plots and fewer intermediate agencies in the utilization rule of information circulation, and it also runs counter to the special need for technical information at different ecological areas.

Some information agencies belong to administration, while some are administered by scientific sectors, thus each agency becomes a complete unit, and each does things in its own way. In this situation, it is very difficult to share information sources with each other, to exchange information with each other, and to cooperate in a broad way. Many agencies duplicate work of other agencies, and the whole information system is just like a "mixture of individual information units."

Why have the service focal points of information agencies of agricultural science and technology been inclined to scientific research for a long period? Generally speaking, there may be the following reasons:

First, China's agricultural science and technology information work develops from agricultural scientific research agencies and their management. Naturally, the information work is closely connected with scientific research either in the basic work, or in the constitution of staff members. Scientific research sectors are in an advantageous position in utilizing the advances of science and technology owing to their being the sectors that concentrate qualified persons and knowledge. They play a role in improving the formation of the approach to "face scientific research."

Second, due to the influence of the scientific and technological system of the Soviet Union introduced at the beginning of the 1950s, a serious disadvantage in China's system is the idea of regarding scientific research as superior to the spread of research

results, and that scientific research and production have systems of their own. The problem that reflects on the service of information of science and technology is that it mainly serves the areas of the scientific research but weakens the transmission of technical information.

Third, people are biased against the role of scientific and technical information because of a wavering in the guiding thought of economic construction in China over a rather long term. Almost all the local information agencies lack either enough motive force to improve their technical service, or the power to serve the rural areas and farmers and spread technical information, due to the inhibition of some factors, such as information consciousness, information acceptability and the conditions of rural dwellers and farmers who are the main users of technical information. Therefore, these agencies have to provide information service for scientific research only.

2. Local and regional agricultural production and rural economic development should demand that the information sectors of agricultural science and technology focus their efforts on technical information services to the rural areas, farmers and the popularizing of agricultural techniques.

Worldwide, information services have come to a stage of development where they are being aimed at special problems. How to further increase agricultural production and labor productivity are the major problems facing China as a developing country. Therefore, providing the large amounts of timely technical information services that are needed for increased regional agricultural production and rural economic development are the key points for most local information services in agricultural science and technology. Especially in the case of the powerful voice of vigorously developing agriculture depending upon science and technology, the agricultural science and technology information service should fully play its functional role as an important foundation and as a "bridge" for spreading agricultural science and technology and popularizing knowledge of science and technology. Based on the needs of agricultural production and economic development, technical information in agricultural science and technology ought to play an important role in at least the following three aspects:

a. Promoting the spread and utilization of research achievements in agricultural science. According to statistics by sectors concerned, about 7,000 research results per year may be achieved by Chinese scientific and technological workers. In recent years about 30-40% of them, however, may not have been utilized, parts of the achievements have been spread but have achieved little. For example, the production of hybrid rice which was initiated in China is 750kg/ha higher than conventional varieties, however, of 32 million ha of rice fields, the planted area of hybrid rice is only 42%. The plastic membrane technique, which is praised as a "white revolution," may increase the crop's output 30-50%, even above 100% if it is used in the crops' cultivation. But the it is widely used in over several million hectares in the whole country. For a lot of scientific research achievements, not only the farmers, but also the information specialists do not know enough, so how can they claim to provide an effective transmission service?!

b. Providing technological services for rural areas, farmers and non-agricultural industries. After ten years' reformation and opening policy in China, a single industrial structure of rural life which lasted many centuries has been broken, a new style industrial structure composed of three parts, i.e., plantation industries, agriculture including forestry, animal husbandry and fishery, and non-agricultural industries including village and urban enterprises, commerce, architectural industry and service industry has been formed. Among them, the development of village and urban enterprises which are the main components of non-agricultural industries is rather rapid. Up to 1988, the total output value of village and urban enterprises in the whole country was 449.6 billion yuan over that of agriculture. This variation of industrial structure provides a great possibility for fully and reasonably utilizing resources to create a rural economy with high efficiency and a fine ecological circle, for changing the situation of 800 million farmers who work for a living, for carrying forward the advantages of Chinese traditional agricultural, for using modern science and technology and for combining both concentrated styles of labor and technology. Similarly, this variation is also a vast opportunity for enlarging the service domain, extending the service content, and enhancing the information function of information agencies of agricultural science and technology, it also provides an opportunity for transferring the focal points of services. At the moment, the local information agencies of agricultural science and technology still look rather weak in providing technological information services to the main agricultural, village and urban enterprises.

c. Popularizing scientific and technological knowledge to raise the farmers' cultural level. Eight hundred million farmers live in rural areas among 1.1 billion Chinese people. This basic condition in China demands that all the agricultural sectors including the sectors of management, scientific research popularization and information services must change their fundamental foothold and key points to rural areas. On the other hand, the fact that in the Chinese countryside the small-scale peasant economy is the major part of the agricultural economy, that the farmer's educational level is very low, and that their productivity is particularly low, must be fully taken into consideration. All these indicate that not only is it a complex social problem to let millions and millions of farmers take a socialist road with China's own features and to reach the aim of common wealth, but also these increase a lot of difficulties for the popularization and application of science and technology, and for information transmission services. Especially in the rural areas liberated early, minor nationalities areas, border and poverty areas where it is inconvenient to travel, poor in economy and backward in culture, it is rather difficult to achieve a great improvement in accepting and utilizing advanced science, technology and information in the short term. These increase the degree of difficulty for information services. The information agencies of agriculture are responsible for improving the transformation of the above unfavorable factors, as well as for making a contribution to improve the information service conditions and to accelerate the development of the economy, by combining with educational services, etc.

3. Conclusion and countermeasures

Based on the above analysis, the authors consider that, for most local and regional information agencies of agricultural science and technology, it is necessary to pay great attention to providing technological information services and popularized units of agricultural technology for the rural areas and farmers so that they define their own true value rather than try to scale the heights of technological services.

According to the actual situation in Sichuan province which has the most population in China, the following are the authors' opinions concerning some problems of information services for the local information units of agricultural science and technology.

a. Enhancing the coordination and management of scientific and technological information work.

Taking into consideration that, at present, both the information services of science and technology and the general information situation are very weak. The information products of China have not been controlled by the market. And for a long time, the weak administrative control of the government over information work has not been useful for the construction of information channels and their rapid development. Therefore, it is necessary to develop a powerful constructive administrative management scheme science and technology information over a rather long period. Thus, our suggestions: i. Changing the present state of "two units one leading group," i.e., both the bureaux of scientific and technological information and their corresponding synthetic information institutes of science and technology are led by the same leading group respectively, and setting up the bureaux of information directly led by different levels of the government or establishing special supervisory agencies of scientific and technological information directly led by different level committees of science and technology. ii. Formulating legal, economic and other relevant laws and regulations through the state legislative body and the government to ensure that information services can be provided smoothly. iii. To meet the needs of the development of the economy and information channel on its own, it is necessary to work out feasible and administratively binding programmes in some important areas, such as setting up the information agencies, establishing goals, constructing databases, and the collating and collecting the references.

b. Reasonably distributing the local information agencies of agricultural science and technology.

At the provincial level academies of agricultural sciences, the present information research agencies should be maintained, their main task may be as follows: providing academic information for agricultural scientific research, providing information services for the leader's policy-making, collecting and transmitting important technological information from in-country and abroad which is concerned with the agriculture of its own province. Setting up an agrotechnical information service agency which is attached to the provincial department of agriculture and animal husbandry, its main

task should be, according to different areas and ecological conditions, to collect and disseminate information concerning technical agricultural achievements and new technology to the basic level information units and to collect and provide information concerning processing techniques of agricultural products, the manufacturing techniques of new products and the market economy.

Setting up the regional information agencies of agricultural technology with regional characteristics in some typical and representative ecological areas. These may be established at the same site as agricultural scientific research organizations depending on the distribution of these organizations.

Setting up and enhancing county level information development and advisory service units of agricultural technology. The following two methods may be considered. One is to set up a common agency including the information unit and the agrotechnical advisory service centre to provide common services. Another is to combine the information unit with the county level committee on science and technology, the association of science and technology, broadcast station or library, founding a county level synthetic information service centre of agricultural science and technology. Its task is, according to the characteristics of its own county and the need for economic development, to directly provide the concerned technological and economic information to the basal level service stations of agricultural technology, scientific popularization stations and farmers, to train the technicians at basal level, and to develop advisory services.

c. Selecting suitable technical measures in line with local conditions.

Based on the situation in Sichuan province, which is a large inland province located on the upper reaches of the Yangtze River. Sichuan is a big granary in the western part of China due to its superior natural conditions and bumper resources. It is also one of China's four forest zones, one of its four medicinal materials zones, and simultaneously, one of the five pastoral zones. The total output of many products of farming and side-line production are at the first rank of whole country. Exploiting Sichuan province will play an active role in promoting China to participate with international economic competitiveness. This gives a very arduous task to the Sichuan provincial information agencies of agricultural science and technology in strengthening the transmission service of technological information. However, the following facts must be seen: the population in Sichuan province is nearly 110 million, among this the rural population is about 90 million, and the proportion of illiteracy and semi-illiteracy is considerably high. About 70% of the farmers in Sichuan do not know new techniques. The average number of scientific workers per ten thousand agricultural population is only 0.34, and 2.59 technological extension personnel. In this case, the local information agencies of agricultural science and technology have the problem of how to select a suitable method of transmitting the technological information. According to our investigation and practice in recent years, at present, the regional information agencies ought to select those technological transmission measures that are rapid, audio-visual, imaginative, correct, lively, easy to be learned and that cover a large area. The broadcast stations, wired broadcast stations and TV stations have been built up in most places, and they

have developed very fast in Sichuan province. Excepting the provincial TV station, sixteen relay stations with a launching power above 1 Kw, and more than 1,000 stations below 1 Kw have been installed in different regions, cities and autonomous prefectures, the area of TV broadcast coverage is over 80% of the standard population in the whole Sichuan province. Most TV stations at the level of regions, cities and autonomous prefectures have their own TV programmes. At district, county and town levels, video projection plots have been set up. Up to 1987, the Sichuan Academy of Agricultural Sciences had accumulated 426 scientific research achievements. If the regional information agencies of agricultural science and technology make them into video tapes and imaginatively show them to the farmers, the deficiency of low educational level for most farmers and the farmers' reluctance to accept the agricultural technological information transmitted by the journals may be overcome, enabling the agricultural technological information to be spread to the farmers rapidly and effectively. In Sichuan province, there are 75 county level advisory centres of agricultural technology and more than 4,000 primary agrotechnical schools established by counties. If the different level information institutes of agricultural science and technology cooperate with them closely, and form a network, then we may combine the "soft" with "hard" sciences and provide a common service. It would play an active role in the development of Sichuan provincial agriculture. In 1988, the Information Institute of Agricultural Science and Technology, Sichuan Academy of Agricultural Sciences cooperating with the Sichuan Broadcast Station held a training class on strawberry cultivation. According to the original plan, the training was to recruit 200 students only, in fact, 1,988 students were accepted. Thirty percent of the students came and attended the lectures in person. Very high efficiency was achieved. This indicates that it is easy to reach the farmers by using modern methods, such as video and broadcast to spread agrotechnical information, and it is an effective approach for information service. Therefore, the authors of this paper suggest that the capable agricultural information agencies continually and in a planned way make a series of video and recorded products which are suitable for the local needs of agricultural technology, whether or not the Committee of Science and Technology stipulates that all the achievements of agricultural research which are fit for the local population and application ought to be produced on video tape by the research units. After those achievements are identified, they should be handed over to the information agencies to dub, then be sent to the basal level agrotechnical advisory stations and information units for dissemination.

d. Establishing and perfecting an information service system which will meet the needs of technological information services, such as document collecting and information providing and a relevant constitution of information personnel.

e. The government ought to allocate basal funds to agrotechnical information services personnel and build the necessary essential installations, so that they will gradually move towards industrialization.

Ideas on Effective Ways of Transforming Agro-Information into a Productive Force

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Abstract

Recently agro-scientific information units have further strengthened their business services along with the reform of the agro-scientific system. In our business work, we have broken with old conventions and opened up new service fields. We are not only providing services to policy-makers in agro-scientific research as usual but also looking at production in order to transform information into a productive force, from which we have obtained great beneficial results. Now we have summed up six ways to change information into direct productive force as follows: 1. Addressing production to provide specific services; 2. Exploiting information sources to convert information services into a production force; 3. Participating in technical markets to provide advisory services; 4. Encouraging information specialists to contract projects in rural areas and bring farmers new technology and technical information; 5. Conducting investigations widely according to the developing strategy of science and economy in the province or in China; 6. Opening up data sources to serve the whole society.

In recent years, agro-scientific information units have further strengthened their business connections and adjusted the direction of their business services. For instance: a. In the past, we put particular stress on serving policy-makers in scientific research. Now we are starting to serve both scientific policy-makers and rural commodity production; b. In information work, we have changed the old processing methods of collection to systematized new methods of collection--digestion--absorption--consultative services--commodity production; c. We have established a system of profitable services instead of the past non-profit services. Based on the above three transformations, it is possible to make scientific information address agro-production and become a direct productive force for us to obtain more economic benefits. However, we still have difficulty in our information business. First, we have to further extricate ourselves from conventional service methods, and smash the trammels of closed working procedures in order to strengthen our service work. Second, we haven't established a proper mechanism to meet the needs of information services suitable to the development of the economy. Third, the quality of our information personnel doesn't fit the requirements of the new types of information services. We have to train our staff members, who will be experts in one thing and good at many--so-called "T-type" personnel. Last, lack of funding and equipment still handicaps the development of information services to some extent. The existing problems suggest that it is necessary to further reform our work system. In order to expand the service fields, enrich the service contents, perfect the service methods

and make information combine with economic needs, we'll offer our exploratory ideas about methods to transform agro-scientific information into a direct productive force from our practical experiences.

1. Addressing agro-production and carrying out information services in special subjects

As the final purpose of agro-scientific information services is to transform information into a productive force, the measurement of service work is to see how social and economic results would be obtained from the transformation of information into a productive force.

In order to bring about the above result, it is necessary for us to provide farmers with specific services according to their demands for information which will help them solve problems existing in agro-production. In 1989, our institute organized a specific service conducted in Kangping County. We organized more than twenty scientists from six different research institutes to provide technical consultations in the county. We organized discussions among the county leaders and technicians and carried out investigations among the farmers to find out what kinds of technology the farmers wanted. After that, we decided to provide the following consultative services in the county: edible fungi production, cotton cultivation, rice seed improvement, establishment of grape orchards, forage sorghum, and corn production. Based on the above contents, we set up more than twenty base centres, each technician working in one base centre for a whole year. We collected about fifty applicable technical data sources and compiled over ten technical documents by the digestion and absorption of the collected data, distributing about 3,000 copies to farmers. We also offered technical courses in four townships to the farmers there, about 2,000 persons attended the courses. According to the information we had, we helped the county purchase 30,000 kg of seeds of improved varieties of pure rice, 4,480 grape seedlings of fine varieties, and over 200 bottles of fungi vaccines, from which 5,000 cans of fungi were produced in a short period. The farmers also trial-produced over 400 cans of maize shoots, and there will be more such canned food to be produced in the near future. Through the work described above, we have realized that the information service work must face the economic construction, and that the information specialists must go to the production forefront to help users make scientific use of information, only in this way, can scientific information be transformed into a productive force rapidly.

2. Exploiting information sources is one of the most important tasks for scientific information work

The conventional method of information service was just to collect, to systemize and to distribute, only functioning as "middle-man" or "bridge." But facing the present situation of deepening the move to transform information into a productive force, such a bridge function is far from meeting the requirements. Information personnel are now badly needed in rural areas to help users create more economic benefits with the exploitation of information resources. Working this way, information can play the lead

role in production. For instance, we obtained information from the periodical *Scientific and Technological Information* that a plant growth hormone "Jinbang No.1" can raise the yield of rice. We immediately organized two technicians to study this piece of information and to cooperate with the Developmental Company of our academy. They gave the data and samples of the hormone to the farmers in Yingchengzi Village to do a developmental experiment. Since the experiment showed that the growth hormone "Jinbang No.1" is a successful medium for yield increase, the farmers have decided to apply it in large scale in 1990. The further exploitation of the hormone will certainly bring about great economic benefits, therefore, demonstrating the active role of information personnel in exploiting information sources in the forefront of production.

3. Participating in technical markets and providing technological consultation

Technical markets are a newly-developed type of market, through which science and technology flows into rural areas as commodities. The flow of science and technology into rural areas as commodities will help the extension of research achievements and new technology, solving problems that exist in agro-production. It is regarded as an effective method for science and technology to transform from knowledge or potential productive forces into practical forces of production. In 1989, our institute took part in activities of technical markets in Yuhong District and Dongling District of Shenyang City as well as in some townships of Kangping County. In the above marketing activities, we sold about 1,000 copies of applicable technological materials and released twelve new varieties of vegetables to the farmers. We also provided some technical consultations in view of the problems the farmers encountered in their production practice, such as the technology of edible fungi cultivation, high-yield cultivation of grapes, and swine-raising. In the technical markets of Erniu Township and Zhangqiang Township, we discussed the possibilities of helping farmers there set up grape orchards and edible fungi processing factories. Our experiences in participating in technical markets proves that a good technical market should first supply applicable technology that farmers urgently need; second possess not only technical data but technical commodities such as seeds, seedlings, vaccines and samples; and third encourage scientists or technicians with wide experience to participate in its activities in order to give timely solutions to various problems found in production.

4. Contracting for technical projects in rural areas to bring farmers new technology and information

This year, our institute has contracted to join with local technicians to produce rice on 160 hectares in a village in Dongling District, directly participating in production and offering technical guidance. We had consulted some new technical data about rice production before the farmers worked out their production plan. With the help of our institute, they added many pieces of new technical information into their production plan, resulting in the village having an advanced technical level in rice production. The activities of seedling raising and transplanting in this village were technically superior to others in the Shenyang areas. As the farmers began transplanting ahead of normal

time in the spring, the rice seedlings revived in good time and grew sturdy in spite of an insufficient water supply from late spring through summer. We also conducted experiments of plant growth hormones in this village. According to recent investigations, the yield of the contracted rice fields has increased by 375 kg per hectare this year. The contracted production target has been attained. The cadres and farmers in the village extend their warm welcome to information personnel who contract projects. Next year this kind of contracting system will be further developed in the village. Our experience tells us that having information units contract projects in rural areas is a possible way to make information integrate with technology and production, finally evolving into production forces. Contracting is a good form of combining the state, the collective, and the individual with the power, the responsibilities, and the benefits respectively. In the above activities, the initiative of information personnel can be brought into full play. Contracting is also a new channel to lead information into economic fields, resulting in direct services to enhance production. The contracting experiences show that an information unit can contract projects on its own if it has enough technicians or scientists who are able to cope with technical problems in production, otherwise, the unit should cooperate with other institutions in organizing contracted projects.

5. Carrying out investigations and studies along with the developing strategy of economy and science in the province or China as a whole

In the last two years, our institute has participated in the investigation program of "Developing Strategy of Open-type Science and Technology in Liaodong Peninsula," which is organized by the Provincial Commission of Science and Technology. The findings reports from our institute have been exchanged at different symposia organized by the academy, the province or the Ministry of Agriculture, and have been published in journals at the provincial level.

Our institute has also participated in the investigations on agro-scientific and technological development in Jinzhou areas according to the needs of strategic research on the development of Liaobe Delta organized by the province. The findings report of the Jinzhou survey has been delivered to the leaders of departments of the province, offering advice for policy-making. The Jinzhou survey has been identified as a major achievement. As the policy of opening to the world is going on in depth and the relationship between China and the Soviet Union is improving, our institute sought for investigative programs on our own initiative and participated in the survey of Soviet agro-product marketing and calculating organized by the Research Center of Agro-developing Strategy, Ministry of Agriculture and the International Trade Research Institute, Ministry of Foreign Economy and Trade. We have now completed writing the survey report on the basis of collecting data and making investigations. The above activities have played an important role in the development of agro-production, and have provided policy-making services to leaders and departments concerned.

6. Exploring data sources and providing good service to society

Data sources are the basis of various activities as far as the information business is concerned. At present, the collection of data sources is limited owing to insufficient funds and the rising price of books and magazines. Under this situation it is important for us to make good use of the data sources available to serve the users. We have done some work in this respect as follows:

First, we have compiled and published various kinds of information bulletins and technical materials. We have published more than sixty issues of our *Agro-Information of Science and Technology*, from which the Beiling Township Commission of Science and Technology, Shenyang City acquired information on rare-earth fertilizers. They sent peasant-technicians to the academy to learn the application methods of the fertilizer and extended the fertilizer to vegetable production, thereby achieving encouraging yield increases.

Second, we provide specific services based on users' demands. The service targets are mainly intended for "Sparkling Plan," "The Key Task Programs of the Seventh Five-Year Plan" and "Plan for Assisting the Poor by Science and Technology." In the past two years, our institute has provided data-processing services to about ten institutions and obtained significant results. For instance, we provided Fushun Beverage Factory information on the utilization of plant protein when they were doing their research on extracting protein from peanuts and soybeans. Our information helped the factory abbreviate their research work, avoiding wrong turns. The factory was able to start their protein-extracting production one year ahead of schedule, gaining considerable economic benefits. It is necessary to use different methods for exploring data sources and transforming them into productive forces. Therefore, the useful value of data sources can be developed further by means of sending information retrieved from data sources directly to the users, contributing to economic development.

In a word, how to transform agro-information business into direct productive forces is quite a large and complex question. Only by adhering to the principles of facing economic construction, strengthening service work and breaking free from the convention of waiting for users at home, can the information business work be transferred to serving scientific research, agro-production and policy-making, from which more economic and social benefits will eventually be obtained.

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Present Situation and Strategy of Development in Information for Agricultural Science and Technology in the East China Administrative Area

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Abstract

This paper deals with the favorable conditions and the advance of information work in agricultural science and technology in the East China Administrative Area. Establishment of a regional network for agricultural information is proposed. Modernization of agricultural information and further exploitation and utilization of agricultural information resources in East China is discussed. Opinions of fundamental approaches and specific measures for reforming and bringing out new ideas to work in agricultural information is explained.

The East China Administrative Area, which includes Zhejiang Province, Jiangsu Province, Jiangxi Province, Anhui Province and Shanghai Municipality, is a region with well developed economy and culture in China. It has favorable natural conditions, and abundant resources both of organizations and manpower. Its agriculture is relatively advanced, with many agricultural schools, research institutes and a great number of personnel engaged in agricultural science and technology. The requirement for agricultural information is therefore very urgent and thus heavily promoted as well. In this region, resources of agricultural information are plentiful and well managed. Since the Third Plenary Session of the Eleventh Central Committee of the Communist Party of China, a strategy for economic development in the sea coastal region and an open policy have been formulated which provide favorable conditions for further developments in agricultural information.

Favorable conditions for further advances in information for agricultural science and technology

In the East China Administrative Area the level of culture and education is rather advanced, personnel of science and technology are numerous and people in the rural areas are more educated than in other places in China. A new generation of educated farmers is growing up, and large numbers of family farms specializing in animal husbandry, aquaculture and crop production are emerging. They are the greatest consumers of agricultural information.

There are six agricultural colleges or universities in the East China region, with large numbers of well-qualified teachers. In addition there are more than twenty professional

schools and training schools of agriculture. Resources of agricultural technicians are plentiful.

In this region there are many higher level agricultural research organizations, for example the well known China National Rice Research Institute, the Institute of Sericulture and the Institute of Tea, as well as provincial and municipal academies of agricultural science, entrusted with major research programs of the country. They carry out frequent exchange with foreign countries and collect large amounts of information from abroad. They are both producers and consumers of agricultural information who act as the main force in producing, transmitting and using the agricultural information.

This region has a population accounting for 29.2% of the total population of the country, while its area of farmland is only 22.5% of the total farmland of the whole country. With scanty farmland per capita, the fundamental way out for agriculture lies in the development of science and technology. Therefore input of scientific research in this region is considerably large and many more research programs are undertaken. As a result, agricultural information is more sought after. This region is rich in cotton, tea, silk and other cash crops that are suitable for foreign trade, so its information work has local applications.

Many cities and towns are concentrated in this region. Industrial development in cities has been bringing along the progress of industrial and agricultural production and supporting economic development in rural areas and small towns, offering a wider market for agricultural information. Many farmers come to seek advice from information institutes in agricultural academies and purchase technological documents, others enroll themselves in training schools of various subjects in order to make themselves wealthy through applying technical methods. Agricultural information specialists are being confronted with new charges.

Present situation of information for agricultural science and technology

Institutes of information for agricultural science and technology have been established in succession in municipal and provincial agricultural academies in East China since 1987, and libraries have been incorporated in these institutes so that agricultural information and libraries are more closely linked together. The staff of provincial or municipal institutes of information, usually consisting of about forty people, undertakes mainly the editing and publication of periodicals and pamphlets in agricultural sciences and technology, review of information, retrieval service, technological advisory service and document delivery service. The department of information and documentation in libraries of colleges and universities is responsible for collecting, processing and reporting information as well as the retrieval service and selective dissemination of information (SDI) for education or scientific research. In agricultural institutes at the prefecture level, an information station is established to carry out information services to grass-roots units of agricultural production and scientific research. A system linking the provincial, municipal and grass-roots levels of information service has been estab-

lished, making agricultural information easily accessible and promoting the transformation of scientific and technological information into productive forces.

The capacity for publication of agricultural books and documents in East China is quite high. More than fifty periodicals are being published and one to two hundred books are issued annually. Library collections in agricultural colleges and universities are plentiful. In the Jiangsu Provincial Academy of Agricultural Sciences, about 140,000 volumes of books and periodical have been collected. Decades of its periodicals are internationally known and subscriptions to them began from the initiation of their publication. There are also some books from abroad and periodicals and documents in Chinese and foreign languages published before liberation. In institutes of information in the Zhejiang Provincial Academy of Agricultural Sciences and the Shanghai Municipal Academy of Agricultural Sciences the library collections are abundant, too. Many of their valuable information resources are awaiting further exploitation and utilization.

Management of agricultural information has begun to be carried out with computers. In order to improve the utilization ratio of documents, the establishment of a document database of specialized subjects has been analyzed and put into practice. In the Institute of Information of the Shanghai Municipal Academy of Agricultural Sciences, a document database specializing in edible fungi has been established, and, in cooperation with the Shanghai Institute of Plant Physiology, online retrieval on a database of biological engineering is carried out. The Institute of Information of the Jiangxi Provincial Academy of Agricultural Sciences began in 1986 to set up a database of its own library collection and to carry out selected dissemination of information services. The Institute of Information of the Jiangsu Provincial Academy of Agricultural Sciences has set up its own "agro-biological technology information database" and "library collection database," in addition to its responsibility as the AGRIS Sub-centre in East China to share in setting up the AGRIS (the International Information System for the Agricultural Sciences and Technology) database.

The establishment of document databases on specialized subjects and selected dissemination of information service is being carried out. Up to now, however, service in covering and manually retrieving documents has been stressed. From now on service in patent information, market information, and sound and images, etc., will be carried out.

Plan for development of information work for agricultural science and technology in East China

East China is not only rich in information resources and technical force, but also full of users of information. As a base of agricultural information production, it has a duty to take the lead in exploiting agricultural information resources and applying modern information techniques. It is of great importance to establish an information industry with regional features of East China.

1. Joint exploitation and utilization of information resources through a network in the East China Administrative Area for agricultural information in science and technology.

Ours is a developing country with a large population and wide territory but limited financial capacity. Dispersed information resources and technical force should be concentrated through setting up a specialized information network linking together institutes of information in provincial and municipal agricultural academies and libraries in agricultural universities to make full use of their agricultural information resources. In order to share information resources, it is suggested that the information network take charge of coordinating library collection development and information processing in the region, exploiting new techniques, creating databases, training the working personnel, setting up joint directories and sharing the establishment of library collections databases.

On the basis of the information network of East China and incorporating information stations of the region, prefecture or county level a linked system of information service can be formed which will accelerate the transformation of scientific and technological information into productive force through joint exploitation and utilization of information resources, technical exchange and popularization of scientific and technological achievements.

2. Establishment of an area-wide search network of agricultural information among administrative areas will realize sharing of information resources.

In developing documental information and modernizing information work, it is necessary to establish a network which ensures close cooperation and sharing of resources among information units. The establishment of China's comprehensive bibliographic database of agricultural information and its computer retrieval network is a large system engineering effort that needs a large investment and can only be realized step by step. At first, it is suggested that we set up an online retrieval service center among administrative areas through the linkage between the AGRIS Sub-centre in East China and the China AGRIS Centre. Then, in two or three years, a network of microcomputer retrieval and a facsimile system within the administrative area will be set up by linking up information departments in provincial and municipal agricultural academies and libraries in agricultural universities. In the second stage, we should strive to establish a secondary network of information retrieval within the administrative area by the 8th Five-year-plan using the institute of information of the provincial academy of agricultural sciences as the node, and connecting information stations of the agricultural institutes at the county level. In the third stage, we should consolidate and refine the construction of the network. The AGRIS Sub-centre in East China should be further equipped with super-microcomputers to produce various sub-databases of agricultural literature to offer direct online retrieval services. It is expected that the computer network for agricultural information retrieval will cover the whole administrative area of East China by the end of this century.

3. Promoting the study and production of databases to form an information industry.

If the database is to be the foundation of the network of information retrieval, it should meet practical needs in education, scientific research and production. In order to avoid duplication in document collection and database construction, it is desirable to organize a combined body and formulate common criteria for division of labor. According to characteristics of agricultural production and scientific research, various kinds of bibliographic databases, transaction databases and numerical databases should be set up, e.g., germplasm resources database, ecological agriculture database, agrobiotechnology information database, appropriate rural technology database, agricultural products market information database, agricultural scientific research achievements database, agrotechnological personnel database, etc. By joint study and exploitation, a series of information products can be developed and offered to the whole society through the network system.

4. Carry out more intensive study on the science of information and extend the realm of information service.

It is desirable to launch a study to determine major or key projects and important policies for the development of agriculture on a national level. Specialized and coordinated research groups should be organized to provide valuable strategic and tactical information through a wide-range of collection, processing, sorting out and analysis of documents. We will strive to make information work pioneer in scientific research.

In order to meet the needs in the development of modern agriculture, information services should no longer be limited to abstracting or document service, and not be directed only at scientific research, but also offer economic information to agriculture for foreign trade. It should also serve the small town industry with market information and appropriate techniques and offer technical advice to various specialized producers in rural areas.

The prospect of information for agricultural science and technology in the East China Administrative Area

As the reformation of the economic system goes forward, information for agricultural science and technology will be shifted from unitary document service to multifunctional and comprehensive service systems. The printed document will not be the only carrier in the transmission of information, electronic high-density storage techniques will be widely used. Various kinds of information will exist in the form of databases which will become the main products of the information industry. Besides the traditional manual examination, documents can be consulted and information can be obtained from the database through various retrieval systems. People will no longer worry about the "information explosion."

Just before the 1990s, the information for agricultural science and technology in the East China Administrative Area will step into a new period of development. Its main aim is to establish a network system for agricultural information retrieval. After the

establishment of China's comprehensive bibliographic database of agricultural information, online services in East China can be launched to realize the sharing of database resources, while the AGRIS Sub-centre in East China plays the role of a bridge in database establishment and information service. East China will take the lead in setting up a regional microcomputer retrieval network and a facsimile network and will command a system of agricultural information using modern technology.

Coordination of Information Work on Agricultural Literature in Northwestern China

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Abstract

In close connection with the practice of coordinating scientific documentation and information on agricultural literature in Northwestern China organized by the Coordination Committee of the Wugong Agricultural Science Research Center (CCWASRC), this paper outlines the progress in coordination of information on agricultural literature, and introduces a related institutional framework, the cataloguing of a joint catalogue and the common sharing of information resources, the training of literature retrieval teachers, translating, editing, and publishing special scientific and technological literature, investigating the existing work on the information of agrosience and technology as well as the activities of a yearly workshop meeting of the coordinating organizations in five provinces (autonomous regions) in Northwestern China. It also deals with the coordinating organizations on the principle of willingness and mutual benefits and the methods of equal consultation in the horizontal coordination, and being able to rely on the backbone force to carry out research work, and discusses how to carry out literature investigation, research, information translation and editing around a certain special subject, which is the effective way to show the benefits of networking by the coordinating organization. This paper also points out the difficulties and problems faced in agricultural literature and information coordination among several provinces and some considerations for future work.

Libraries and information departments are tied together in information dissemination. Strengthening horizontal and multi-way coordination will change the long-term situation of a lack of coordination and of disconnection of library and information institutions and will achieve a common sharing of information resources, and also is an important guarantee to improve service benefits. In close combination with more than five years' experience of the Coordination Committee of Wugong Agricultural Science Research Centre (CCWASRC), the paper deals with some problems of horizontal ties among the agricultural libraries and information departments of five provinces (autonomous regions) in Northwestern China.

THE PROCESS OF COORDINATION

Inspired by the strategic thoughts of exploiting vast Northwestern China, ten representatives from the agricultural institutions of higher learning and scientific research

institutes, met at an initial seminar on libraries in July 1984, proposed the establishment of the Coordinating Organization of Agricultural Libraries and Information Departments of five provinces (autonomous regions) in Northwestern China (COALIN), and determined that the CCWASRC should be responsible for the liaison work. After a period of time for informal discussion and preparation, the COALIN which included Shaanxi, Gansu, Ningxia, Qinghai and Xinjiang, was established in Wugong Agricultural Science Research Center, Yangling, Shaanxi, in Dec. 1984, and at the same time, held their first seminar on library and information.

The COALIN has 36 member units including the information research institutes of the agricultural academy of each province (autonomous region), libraries of agricultural institutions of higher learning, information research rooms of research institutes of agriculture and biology distributed over the five provinces (autonomous regions) under the jurisdiction of Academia Sinica, the Chinese Academy of Agricultural Sciences and the central ministries, and information research rooms of research institutes of agriculture, forestry, water conservation, livestock, biology and ecology under the jurisdiction of the provinces (autonomous regions). Based on statistics, the member units of the COALIN have more than 750 staff members, a library collection of 3.338 million books, 2.402 million pieces of information, subscriptions of various kinds of current issues of which there are 1,685 foreign periodicals (1988).

The leading framework of the COALIN is the Coordinating Committee of Agricultural Libraries and Information Departments of Five Provinces (Autonomous Regions) in Northwestern China, consisting of eleven membership units. The CCWASRC is the director unit, and each province (autonomous region) has one deputy-director unit. The coordinating committee can use the yearly workshop meeting of the coordinating organization to examine the coordinating work of the previous year and to discuss the coordination plan for the coming year and decide the important issues in coordination.

The establishment of the COALIN marks the beginning of a new stage in horizontal coordination and exchange of agricultural libraries and information departments of the five provinces (autonomous region). The following work has been done in these years:

1. Cataloguing the Joint Catalogues.

In 1985 and 1986, the *Joint Catalogues of Periodicals of Current Issues in Foreign Languages of the COALIN* was twice catalogued. In 1988, the joint catalogues reported 1,685 periodical editions in foreign languages that were collected by 31 membership units, (of which, there are 1,218 in western languages, 280 in Russian, 165 in Japanese and 22 published in Hong Kong and Taiwan). In 1986, the *Joint Catalogues of Retrieval Periodicals in Foreign Editions of the Library Collection of the COALIN* was catalogued, which includes a library collection of 305 retrieval periodicals in foreign languages at the nineteen membership units, (of which, there are 192 in western languages, 108 in Russian and five in Japanese). The beginning/ending years of the catalogue are 1907-1986.

By cataloguing the two joint catalogues above, the membership units can now compare the library collections of foreign journals or periodicals with each other, thus, promoting the common sharing of foreign journals and periodicals among the organizations.

2. Editing and Publishing the Selection of Papers Concerning the Strategies of Agricultural Development in Northwestern China.

In 1986, the editing and publication of the *Selection* covers 300,000 Chinese characters of the bodies of texts and with 250 subject titles from the library collections of the member units attached. This selection (internal issue) can be a good reference of the policy-making bodies and experts, scholars who are engaged in studies of soft sciences.

3. Training Teachers in Agricultural Literature Retrieval.

In October 1985, the training course for teachers in agricultural literature retrieval was conducted in Wugong Agroscientific Research Center. Twenty-five participants from twenty-two agricultural institutions of higher learning and agroscientific research institutes were well trained. Most of the participants came back to their units to take up the teaching of an literature retrieval course and practical work in literature retrieval.

4. Investigating into the Existing Conditions of Scientific Information on Agriculture.

In 1987, the COALIN carried out an investigation into the existing conditions of agroscientific information of the five provinces (autonomous regions) in Northwestern China. To begin with, the agroscientific information research institute of agricultural academy in each province (autonomous region) was responsible for investigating the existing conditions of agroscientific information in that province (autonomous region). Second, the director membership unit carried out the comprehensive analysis and study of the investigated results by the information research institute in each province and reported them to the 1988 yearly workshop meeting of the COALIN. The report on the investigation into the existing conditions of agricultural information work of the five provinces (autonomous regions) was sent to some related leading departments so as to attract their attention to the work on agroscientific information.

5. Translation, Editing and Collection of [Hippophae] Literature.

In the year 1987-1988, in order to meet the needs of research, exploitation and utilization of seabuckthorn [*Hippophae rhamnoides* L.] in the five provinces (autonomous regions) and the whole country, information researchers in some membership units were organized to retrieve 797 pieces of [Hippophae] literature reported in more than thirty different foreign journals or periodicals since 1950, and *Hippophae Abstracts* with its indexes of subjects, authors and patent numbers attached was translated and edited. This *Hippophae Abstracts* was formally published in 1988. In the years 1987-1989, the information researchers were also called on to translate a 1987 Soviet monograph on Hippophae into Chinese and also the Soviet 1986 *Proceeding of Papers Concerning Hippophae Biochemistry, Introduction and Breeding* into Chinese. Both of them have been published. In addition, some reference materials concerning [Hip-

pophae] were translated, and investigation into the literature was carried out in coordination.

6. Coordinating the Subscription of Journals and Periodicals in Foreign Edition and the Common Sharing of Information Resources.

Making use of joint catalogues of current issues in foreign editions of 1988, which was catalogued by COALIN, beginning in 1988, the coordinating organization coordinated the membership units to subscribe to the original-edition journals in foreign languages so as to reduce the repetition of subscriptions to save funds. In just the member units of Shaanxi Province, the duplications of subscriptions to foreign journals were decreased by 28 titles, saving RMB 16,769 Yuan in 1989. Based on the principle of mutual benefits, the coordinating organization organizes the membership units to share information resources with each other and further promote the benefits of the existing foreign journals of original editions to the fullest.

7. The Yearly Workshop Meeting Activities.

Since the establishment of the COALIN, it has held the yearly workshop meeting four times in each province by turns in the years 1985-1988. One hundred thirty-three papers have been presented, from which twenty papers were selected and evaluated as excellent in this field.

The coordinating organization holds the yearly workshop meeting periodically, which is favorable for academic exchange and discussion. The solicitation of papers for the yearly workshop meeting plays a role in encouraging librarians and information personnel in agricultural endeavors to gain professional proficiency and activate an academic atmosphere. So it is favorable for improving personnel qualifications. Also, the yearly workshop meeting provides agricultural information personnel with a chance to come in direct contact with each other through discussions at or outside the meetings. This kind of contact with each other can strengthen the close connection and friendship among agricultural libraries, information units and personnel, thus creating a good foundation for horizontal ties with agricultural books and information in Northwestern China.

EXPERIENCES OF COORDINATION

1. Horizontal Coordination Should be Based on the Principles of Willingness and Mutual Benefits.

The difference of vertical management is mainly determined by the structures of state power while horizontal coordination is chiefly determined by the benefiting structures. It is necessary when people come to know the necessity of coordination and make sure that they will benefit from it that they are happy to join the coordination. When some libraries and information departments do not come to realize it for the time being, we can wait for them. Those who join the coordinating organization earlier or later, are all welcomed. Those who join it at the beginning and are unwilling to remain in it, later are also allowed to withdraw from it. Since the establishment of COALIN, there have been five membership units withdrawing from the organization of their own accord,

but there are six units applying to join the organization. And hence, the whole organization is consolidated basically.

The coordinating actions come from the coordination concepts of those who participate the coordination, while the coordinating actions meet success, and in return, play a positive role in strengthening the coordination concepts.

2. Equal Consultation is the Basic Working Method in Organizing Horizontal Coordination.

The important significance of developing horizontal coordination lies in breaking up the restrictions of the original administrative jurisdiction relationship. But the coordinating organization can not change the original relationships of the regions and administrative jurisdictions to form new ones. As a result, the CCWASRC with its organizational nature has been selected as the director membership unit of the COALIN, whose relationship with other membership units is not administrative but an equal relationship, and each membership unit has its independent rights with each other. Accordingly, the director membership unit can only depend on equal consultation to carry out work and to play a role in organizing, liaising, coordinating relationships and integrating suggestions and opinions of all the member units. Because of existing conditions and a need to be able to obtain coordination among the agricultural libraries and information departments, we can only adopt the coordinating ways loosely at present. Some common coordination activities need to be organized in a unified way. The principle of seeking truth from facts, and doing what the units' strength allows must be followed, with the workload capacity of the member units taken into consideration.

3. There Must be a Backbone Force.

The backbone force of member units of the COALIN have been formed by the information research institute of the agricultural academy of each province, the libraries of agricultural institutions of higher learning and the information research rooms of research institutes concerning agriculture and biology located in Northwestern China under the jurisdiction of the Central Government. Relatively, these units have a better foundation, greater influence and a batch of the eager and foresighted activists of the agricultural library and information community as their backbone. We fully depend on this backbone force to excel in coordination, to bring their guidance into full play to influence other member units, and to unite all the member units to push the coordinated work forward.

4. Carrying out Information Investigation, Literature Editing and Translating Around a Special Project is an Important Way to Bring the Benefits of a Network of Coordinated Organizations into Full Play.

The COALIN links more than 36 libraries and information departments in agriculture, forestry, water conservation, animal husbandry, biology and other related disciplines in five provinces (autonomous regions), whose personnel qualification structures, literature retrieval precision and recall rates and inter-supplementary functions are not to be compared with those of any single department of books and information. The benefits of this network can be brought about by carrying out information investigation,

literature translation and publication around some certain special projects. For a special project to be selected, there must be a social need, reliable task sources, ensured funds and be capable of taking advantage of library book preservation.

MAJOR PROBLEMS AND COUNTERMEASURE

First, the problem of fund resources. Each member unit of the COALIN belongs to different administrative levels, systems and provinces (autonomous regions) with multiple leadership so that it has no unified fund resources. In addition, this coordinating organization consists of libraries and information departments. In recent years, operating expenses have been reduced, and expenditures have been increased by a wide margin so that the departments of books and information offer free services. In this case, it is unrealistic to require the member units to assist the coordinating organization with funds.

Second, because of the problem of fund resources, not only are the coordinating activities confined in width and depth, but the expense of the yearly workshop meeting also surpasses the capacity of some member units.

Based on the above conditions, the member units decided that COALIN should continue to exist, but its mode of activities should be adjusted to reduce the frequency of its activities and to probe into how to make horizontal coordination more active to increase its vigor starting from the present existing conditions at the 1988 yearly workshop meeting. As a result, (1) the yearly workshop meeting of the coordinating organization has been changed from once a year into once every two years. Apart from the necessary academic discussions, the contents of the workshop meeting should have one or two main subjects to strengthen actual working experience, particularly the experience of changes in reforms, opening up and vitalization starting with actual practice. (2) Future tasks of COALIN should be within the range of professions of each member unit with the province (autonomous region) as a unit. We should concentrate on the subscriptions to foreign books and journals in their original editions and on the implementation of common sharing of information resource and not do something difficult with limited funds. (3) While doing a good job in literature and information work, the coordinating organization should further gear its work to the need of society and make itself known through various ways, and obtain support and understanding from government departments and organizations to undertake more tasks in information investigation, literature editing and translating around some special projects to create a better environment in which the coordinating organization can exist and develop.

From a systematic development point of view, we hold that in order to meet the needs of agricultural development in Northwestern China and a realistic agricultural literature and information network, there should be a multiple-layer vertical and horizontal combination of local network. That is to say, a subsystem of a vertical network including an agricultural information network at provincial, prefectural and county levels connected through the information research institute of the agricultural academy of each

province (autonomous region), agro-educational library and information networks, scientific and technological popularization and extension networks of agriculture and forestry as well as the horizontal coordinating organization system of agricultural libraries and information departments of multiple layers of disciplines in the establishment of wide connections with information departments of finance, light industry, food industry, foreign trade, supply and marketing systems and some related national ministries and committees, have formed an intricate, far-reaching network for making information exchange smooth. This is favorable for the control of multiple information flow, speed, and direction to make information flow to users according to the objectives and purposes in a fixed channel. In this way, the benefits of the network can be expanded. Accordingly, with the establishment and development of agro-information network systems, the work of COALIN and the benefits of the network systems will be further developed and improved.

Discussion on Elementary Assignment on Information of Agricultural Sciences and Technology at the Provincial Level

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Abstract

The basic functions of information for agricultural sciences and technology at the provincial level are: (1) to set up a local document database and numerical database and their supporting libraries; (2) to carry out information services to meet demands in scientific research, agricultural production and policy making; (3) to edit and publish periodicals in the sciences, technology and information and (4) to establish an information network. At present, document management should emphasize purchasing important books, core periodicals, index journals and local publications; and coordinating the ownership and the sharing of information resources. Importance should also be attached to the application of computers in the field of library and information work. Priority should be given to rural areas in supplying information on appropriate technologies and to scientific research fields in providing service to specific programs such as document retrieval. Priority should also be given to selected subjects of information research to meet the demand of macroscopic policy making. Journals of information and technology should have their own features and suit the needs of readers on different levels. It is necessary to extend information exchange internationally. Focal points of the information network should be cooperation and coordination in service and management in sharing resources with each other.

Along with the implementation of reform and the open policy in the recent ten years, demands for information about science and technology in scientific research, production and policy making have become more and more urgent. In most provinces (and in autonomous regions and municipalities directly under the Central Government as well), institutes or centers of information have been established in academies of agricultural sciences and even in administrative departments of agriculture, and have accomplished much in information research and information services for scientific research, agricultural production and macroscopic policy making for the locality. Through efforts over the past several years, a network of information for agricultural sciences and technology organized by centers at national, regional, and provincial levels has been built up in our country, and international exchange and cooperation in information for agricultural sciences and technology has been greatly developed. In our briefing, we will try to inquire further into the patterns and elementary jobs of

information work in a provincial academy of agricultural sciences in order to fit local developments in science, technology and economy.

1. Establishment of a local document database and numerical database, and replenishment of libraries as their support

At present, printed material is still the main carrier of information, however, audio-visual information, and machine-readable information have been developing rapidly. As the major units for the collection of agricultural documents, institutes of information at provincial agricultural academies should, on the basis of their present library, enlarge and appropriately process their collection, and manage to keep continuity and integrity of their scientific and technological documents, in order to meet the local needs in technological and economic development. Over a relatively long period from now on, books, periodicals and some non-open publications will still remain the most important information sources in our country, and to them attention should be paid. Higher authorities are expected to give enough funds to insure book purchase every year.

As economic conditions are now difficult in our country and book prices are soaring, libraries in provincial academies should be circumspect in managing their limited funds. It is suggested that attention be focused first on books, periodicals and retrieval journals at home and abroad which are urgently needed in the province for scientific research and production. Of course, it is also necessary to attach importance to the collection of books and journals published within the local province and administrative area and pay special attention to academic theses, patent documents, statistical data, and standards, as well as important non-open publications. It is desirable to establish a mutual borrowing network among libraries nationwide or within the administrative area to avoid unnecessary duplication in purchase. It is also desirable to publish catalogs of foreign books and successive publications and to supply duplicates and microfiche for linking up and sharing information resources. As China is a developing country and has thirty-one provinces, sharing information resources is an essential way for insuring and improving scientific and technological information service in agriculture. Many libraries are still accustomed to place their emphasis on collection building rather than on the use of their accessions. It is necessary to shift this old viewpoint to the improvement of services such as recommending new books, SDD (selected dissemination of documents) service for some specific programs, compiling bibliographies for specialized purposes, etc., to enhance the utilization ratio of the collections.

Computer databases are necessary in the modernization of library and information services. Microcomputer-based bibliographic databases should be established in every province to carry out document administration and retrieval services. Document databases, factual databases and numerical databases in special fields of study should be developed according to the division of work among administrative areas, aiming at the establishment of a network of databases nationwide. It is also desirable to set up specialized branch bases and to carry out the interchange of information through disks or optical-storage transcription. As the initiation of the above mentioned jobs has been late in our country and there are blank spots in some places, the higher authorities

should take the matter seriously and allocate enough funds and personnel to hasten the steps of improvement of information service.

2. Make a good job of information bank and information service to meet requirements in scientific research, production and policy making

There are three kinds of users in information service of agricultural academies: (1) the staff of researchers in the academy; (2) vast number of agricultural technicians in the grass-roots and farmers; (3) leading cadres concerning to agriculture. Scientific researchers need up-to-date information. They require primary documents as well as those secondarily and thirdly processed, in addition to retrieval service to their appointed programmes. In a provincial academy of agricultural sciences there are scores or nearly one hundred of research projects. It is impossible, in the near future, for information research to attend to each and every aspect of the numerous projects. Therefore information research in the academy is bound to make its key points stand out and to form its own distinguishing features. In Jilin province, for example, emphasis has been laid on soybean and Indian corn; in Shanghai prominence is given to edible fungi; while in Fujian province study of agriculture in Taiwan is highly valued.

As persons in special field of study are usually well qualified in making use of scientific and technological information, it is important to carry out retrieval service (manual, on magnetic tape, or on-line operation) and other kinds of service to their projects. Experience in Shanghai, Jiangsu and Sichuan indicates that 2-4 persons are generally enough to carry on good service to several decades of scientific research projects, such as in providing lots of important information and scientific grounds of argument for the initiation of a project to avoid unnecessary repetition, as well as for appraisal of achievements in scientific research.

To agricultural technicians and farmers in the countryside, information of practical techniques and of the market is most desirable. Many provincial academies have explored in this field and shaped distinctive features of our country in agricultural information service, by publishing scientific and technological newspapers, popular science pamphlets and video tapes, conducting training courses or correspondence courses, exhibitions, science and technology markets, offering technological advice, etc. In 1984, we dispatched agricultural technicians to Dongxin State Farm and Gangbu State Farm to offer overall technological service in zinc fertilizer application to rice, cotton, Indian corn, peanut and soybean on 32,000mu (help purchasing fertilizer, conduct comparative tests, run training courses, etc.) and reaped all-round bumper harvest, resulting in economic benefit of 559,000 yuan, and in the mean while, gave a good demonstration to the surrounding 1,000,000 mu of farmland to use zinc fertilizer which brought much yield increase. Institute of Information of the Tianjin Municipal Academy of Agricultural Sciences conducted training course and advice on the control of persimmon fruit worm (*Kakivoria flavofasciata* Nagano) in two villages in Ji county and satisfactorily raised the yield by 375% and 500% respectively. In the light of reports by Shanxi Provincial Academy of Agricultural Sciences on successful intercropping

Indian corn and *Pleurotus ostreatus*, the institute conducted training course of edible fungi cultivation for twelve times, spread the techniques rapidly, doubled the area of edible fungi culture in municipality of Tianjin, and resulted in considerable social-economic benefit. Academies of agricultural sciences in Jiangsu, Sichuan, Shanghai municipality, etc., have been, in recent years, repeatedly conducted, on the basis of popularization of new technology and new accomplishments in scientific research, jointly with broadcasting stations and agricultural administrations of provincial or municipal levels, training courses and correspondence courses (with thousands of attendants) for fish farming with cultivated grass, sheep raising, rabbit farming, swine farming and feed production, chicken farming, edible fungi cultivation, processing of agricultural products and their by-products, snail culture, straw berry cultivation, etc. Institute of Information of the Shanghai Municipal Academy of Agricultural Sciences has successfully run, jointly with farmers specialized in viticulture and poultry farming, cooperatives of agricultural sciences-technology-and-production to carry out popularization of practical techniques and train qualified personnel. Academies of agricultural sciences in Jiangsu, Fujian, Shandong, Anhui and Zhejiang have compiled *Jiangsu Agricultural Sciences and Technology Weekly* and numerous pamphlets, for example "Appropriate Techniques for Fish Farming," "Techniques of Edible Fungi Cultivation," "Multipurpose Use of the Rice Grain," etc. In addition, they have produced numerous sets of video recording, such as "Fish Farming on the Basis of Grass Cultivation", "Courtyard Economic Plants and Animals," "Economies of Irrigation Water on hilly Land Cultivation," "Symbiotic System of Rice, Duckweed and Fish," etc. At present, technological information service in Hebei province has got into a continuous series of information-technology--production-market and has been highly esteemed by the users. All the above mentioned works have activated the information to stimulate the transformation of scientific and technological accomplishments into productive forces, and in the meanwhile, the actual strength and activities of the information units are strengthened through paid services. It has been indicated through practice, that the vast rural areas are wide markets of agricultural information. Accomplishments of agricultural techniques in stock can be used to enhance significantly the productive force and social economic benefit through information medium and extension work. Higher authorities require various documents and reports on based of facts and sound judgments provided by information units in their policy making. In recent years, the provincial governments, the commission of science and technology and the commission of agriculture rely intentionally on information research of appointed subjects in their decision on agricultural policies, macroscopic plans and development of new fields.

"Calculation of Agricultural Structure in Rural Areas of Shanghai" and "Developmental Study on the Social Economy of Chongming Island" carried out by the Institute of Information of Shanghai Academy of Agricultural Sciences, and "Studies of Agriculture for Foreign Trade" and "Diet Components of the People in China" by the agricultural academies of Fujian and Jiangsu have won appreciation from higher authorities or have been adopted by policy making departments.

Of the above mentioned aspects of information service, attention should be paid to the needs of the development of a commodity economy and in the implement of the national "Plans for a Rich Harvest" and "Plans for Post-haste Improvement of Agricultural Production." Information on appropriate technology, document retrieval and service to appointed scientific projects are the basic functions of information service. Information service must be developed in accordance with the situation in China. As research in information is time-consuming and can only be done by qualified personnel, key points should be made obvious at the initiation of research projects and closely connected to the macroscopic decision on policy and, in the meantime, prospective readers of the results of information research should be determined beforehand.

3. Publication of various kinds of journals on agricultural information and technology

Agricultural production is significantly different in various localities throughout the vast area of China, editing and publishing various kinds of journals on agricultural information and technology is an important job in the provincial academies of agricultural sciences, especially because in the rural areas at present there are only four agricultural technicians for every ten thousand people and each of them is responsible for 7,000 mu of cultivated land. Publication of agricultural scientific and technological journals is urgently required in releasing accomplishments of scientific research, popularizing advanced techniques and improving the progress of agricultural production. More than 1,000 journals have been published openly or within limited circles since the foundation of the People's Republic of China in 1949.

Periodicals published by institutes of information at provincial academies of agricultural sciences can be divided into four categories--academic, technical, informative and popular. In 1988, the total issue of the intermediate comprehensive periodicals on agricultural sciences and technology, e.g., *Zhejiang Agricultural Sciences*, *Sichuan Agricultural Sciences and Technology*, etc., amounted to 194,400. These are the earliest and most popular periodicals on agriculture at the provincial or municipal levels. They are important vehicles for reporting local achievements in agricultural research and popularization of advanced techniques, as well as important windows through which the level of local scientific-technological progress and productive development can be seen. The publication of information periodicals in agricultural science and technology (e.g., *Agronomy Abroad: Rice* and another fifty odd titles) has become systematic and the publication policy has been made clear. Some of these periodicals are also edited and published by institutes of information of provincial academies. Academic and popular journals edited in provincial academies (e.g., *Acta Agriculturae Borcali-Sinica*, *Acta Agriculturae Shanghai*, *Southwest China Journal of Agricultural Sciences*, *Soybean Science*, *Peasant Family Adviser*, *Scientific Experiments in Agriculture and Forestry*, etc.) are published for international and domestic academic exchange and for the popularization of scientific knowledge in rural areas. A publication system for a complete set of high, intermediate and popular agricultural periodicals has been established in some provinces. Specific features and increasing quality will be their main targets hereafter. *Jiangsu Journal of Agricultural Sciences*, edited by the Institute

of Information of the Jiangsu Academy of Agricultural Sciences, has already been used for international exchange with 106 units in nineteen countries, whereupon the information resources of the institute were greatly increased.

4. Establishment of an information network

Generally speaking, a province in China has an average territory of more than one hundred thousand square kilometers and a population of several tens of million people. Provincial academies are not able to assume overall responsibility for information service to the vast rural areas. An agricultural information network has been established by the agricultural academy, the agricultural administrative department and the agricultural college in Jiangsu, Zhejiang and Shanghai. Interprovincial connection of information networks has been realized in Jilin, Liaoning and Heilongjiang. Seminars and training courses are carried out in each of these provincial information networks, to promote the progress of the information industry. In interprovincial cooperation, it is important to stress the mutual supply of information sources and services to the farmers in rural areas through technological advice, technical training, and technological contracts or even the cooperation of agricultural information technology and production to connect science and technology information with local economic development.

Conditions are quite different among the various provinces, municipalities and administrative areas. We have just touched the general character and fundamental functions of information work in provincial academies, but no uniformity should be imposed. Only through diversified information services in every academy can information for agricultural science and technology be bright and colorful and satisfy different requirements.

A New Domain of Agricultural Information Service at the Provincial Level – The Combination of Information Analysis and Database Building

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Abstract

The South China Subcentre of AGRIS has conducted subject information analysis for policy making aiming at particular issues on productive economy and technological economy, resulting in the promotion of agricultural production and agricultural sciencetech. There has been a good social benefit from this kind of service.

A new concept of information service must be fostered, only retrieval is inadequate, a way to concentrate on essentials based on a great number of documents to provide users with the best information is needed. This is a new way to actively serve the particular users according to their particular inquiries.

OMAS (One Move Accomplishing Service) is suggested in the paper as the main part of an agricultural information system at the provincial level. It means that an answer is made exactly by aiming at the requested matter by the user, and is immediately applicable. This is the objective demand corresponding to the provincial circumstances. A province is the central link in message dissemination from the nation and the world to the grassroots. The most important role of a provincial information organ is to transform the national and international message into one directly applicable for the grassroots in accordance with the needs of the province.

A database would be more exact and practical, if it were set up on the basis of an information survey and analysis, so it is necessary to combine database construction with information analysis.

PROGRESS OF INFORMATION SERVICE IN GUANGDONG

As one of the information institutions of Guangdong Province, this Institute was founded at the beginning of the 1960s. At that time, it was mainly doing book/periodical collecting and cataloguing, agricultural sciencetech periodical editing and foreign sciencetech literature translating to introduce the updated agricultural research findings in the Province and the developmental trends of foreign agricultural sciencetech in the world. All of this was only for the use of agricultural scientists and advisory officers. The tasks of the Institute have now been expanded in different stages. During the mid-1970s, subject information analysis was developed with analysis only on an individual dis-

cipline/event such as the progress of rice breeding in and out of China, the new orientation of plant protection, etc., mainly for the use of persons engaged in scientech plan management and project arrangement. Later, subject analysis which was integrated between subjects and overlapping factors were also conducted such as the developmental analysis of sugarcane production, etc., in order to improve yield increase and provide suggestions directly helping the growth of production economy. In the 1980s, to meet the needs at the leader's level in decision making, subject information analysis specially for policy making advisory service was developed. They dealt with themes such as, the adjustment of the agricultural structure, coordinating growth between grain and economic crop farming, decisions for predicting the development of agricultural scientech, the expansion of export-oriented agribusiness, market analysis on Hong Kong agricultural commodity trade, etc. A number of reports were completed, used at the leader's level in decision making and were well-received by users like the Agricultural Committee, the Scientech Commission and the Scheming Committee of the Province. It was shown that all the works resulted in good social benefit for they had accelerated the development of agricultural production and scientech while they were put into practice. The advisory subject analysis has now become the top information service in our institute. It aims at specific users and application targets to tap the domestic and international information sources, then to get it processed, analyzed, synthesized and bring forth new ideas for the resolving of specific problems on production economy or technological economics. In this way, information services have closely combined with economic growth. Guangdong began to set up an agricultural database in the middle of the 1980s. The 'Guangdong Agricultural Production Database' was completed in 1988, and efficiently met the needs of different levels of agricultural units for the planning of agricultural production. It has promoted the modernization of agricultural information service.

NEW CONCEPT OF AGRICULTURAL INFORMATION SERVICE

What does 'Information' mean? There have been various ideas about this in the world. It is beyond this paper's scope to discuss the exact definition of 'information,' and as a matter of fact, the definition of information service is always expanding. At the beginning, it means simply providing books and files of documents. Then comes indexing for the convenience of searching. The first revolution of information technology was brought about when the modern computerized information network was established. It unprecedentedly raised the efficiency of information storage, transmission and utilization. But information was still at a standstill waiting for people to access it. Information can be activated aiming at some particular field to actively resolve problems only when a variety of databases from numerical, to factotum databases to expert systems come out, at that point information service has taken a great step forward. People extricate themselves from a perplex of information explosion to a certain extent by concentrating or condensing the huge documents into the most vital message for the users. The embracing but inactive databases are not the solution for satisfying the urgent needs of people. A new concept of information service has to be paid great attention to, that is to classify and digest the tremendous amount of information resources, then to actively provide the particular user with a certain

message that answers the specific inquiries of the searchers. From the concept of 'information,' the inactive stored document is not 'information,' but an available information source, although it is retrievable. 'Information' is just what meets the user's need by extracting, concentrating, condensing and synthesizing the information source concerned in accordance with the specific questions. So information service includes not only retrieving, but also the deep processing procedure as mentioned before to build up a 'User-oriented System.' In this way, a great deal of time spent on searching and analyzing by the users can be saved. Information service could even go deeper to create a synthetically optimized combination message for the users with particular demands. This is the implication of a new concept of information service featuring its exactness, centricity, applicability, systematization and creativeness.

STRATEGIC CHOICE TO EXPAND AGRICULTURAL INFORMATION SERVICE

One of the strategies to be chosen is to establish the all-inclusive information database for an on-call service. Another is an effective strategy called 'One Move Accomplishing Service' (OMAS), by which one can directly answer the particular request of its clients. The agricultural information system at the provincial level should take the latter as the main part of its service. The former will be the support of OMAS, although it is much more general. For instance, one of the users needs an analytical report on the status and trends of agricultural hightech to consult when he is planning the development of agricultural hightech. You are not providing OMAS, if only a great file of documents from databases dealing with the right subject is delivered. Digesting, processing and outlining must be done before a useful background report and proposal can be made for the particular user. There are different degrees in OMAS in terms of its depth and specificity. The first degree is SDI (selective dissemination of information), i.e., offering a bibliography of documents, an index of abstracts or full text according to the orders of the user. The higher degree is the survey reference information to answer the user's inquiry. The highest one is to undertake the subject information research and process what they have retrieved from the information source, then investigate the change of the situation concerning the requested subject before they can report their proposal to the questioners. The comprehensive strategic information and policy-making information particular for the leading organization belong to the highest information service. It is done in the way mentioned above, and includes information consultation and policy-making consultation, etc., and we see how wide the scope of the subject is. A computerized database can be used for all the degrees of information service in the form of a subject diskette for retrieving. We should choose the strategy for building up our own database on the principle of small-sized, decentralized, specific, monographic, diversified, and applicable in order to meet all the users' needs. It is an objective certainty to fit the provincial circumstances, if OMAS is emphasized as the core of provincial agricultural information service. The reasons are: First, a province is the key link for the transfer of information from all over China or the world to the grassroot unit. This is the most important role of an agricultural information organization at provincial level to handle this transfer according to the needs of the provincial production, the scientech unit, the enterprise and the peasants; Second, the development of

commercial economy in Guangdong more urgently needs the inclusion of agricultural information service to be suitable and prompt. It also needs the information organization to provide the information on policy making for technological economy, developmental planning for production and scientech, market trend analysis, exploitation of new technology and new business, as well as the world wide technical introduction, which are able to directly answer the questions. The on-call retrieving service is no longer to meet the needs of the development of commercial economy; Third, a province does not have enough financial capacity for information storage. Unlike the information organizations at the national level such as the Scientech Documentation and Information Centre, Chinese Academy of Agricultural Sciences, the Information Institute of Academia Sinica, the Library of Academia Sinica and the information institutes in the related departments, they have kept more than 1,000 titles of periodicals dealing with agricultural scientech and some other related basic applied sciences. In Guangdong, there are only about 300 titles of scientech periodicals stored in different research organizations, colleges and universities. It is only 20-30% of what is kept in the information organization at national level. It is only a drop in the ocean when compared with the quantity of agricultural and related documents published each year all over the world. The provincial information organ has to transform the national information source into the products directly serving the users in a province. It would make the provincial information product better and greatly raise the utilization ratio of national information source; Fourth, to contact the OMAS directly with economic undertakings or institutes it is more advantageous to get better social/economic profits from information. The technologies of the microcomputer, CD-ROM/DRAW and communication in the modern world have facilitated the modernization of OMAS for the agricultural information service at the provincial level. It strengthens, broadens and deepens OMAS by establishing different types of databases through information processes aiming at specific needs of the user, then provides them with products in diskette or CD-ROM forms immediately promoting the growth of the technological economy. It is becoming a giant information industry of the modern times.

To build up databases on the basis of subject information analysis will result in better accuracy, more optimized systematization and better applicability because a great amount of information concerning the requested subject must have been collected, digested and selected, even deliberated, summarized and synthetically created during the analysis procedure. Secondly, various considerations from specialists are also accepted so that the database is set up on a more solid foundation. In recent years, our institute has conducted a subject information analysis on the topic of 'Analyses on Hong Kong Agricultural Commodity Market and its Developmental Prediction.' This is to meet the needs of export-oriented agricultural development and considers that most of the agricultural commodity is for the Hong Kong market owing to the favorable geographical conditions of the Province. We have the plan to put all the collected, assorted and processed data/information into the database named 'Trade and Scientech Database on Hong Kong Agricultural Commodity' after the report of the project is completed. This database will be well-used by agricultural production units and international trading departments in managing the exportation of agricultural commodities. We are quite confident about constructing the database after doing surveys and

analyses, but are still not sure if our investment will be profitable. We suggest that the Chinese government should support the database construction in provinces by providing information sources and funds. It is the right way for agricultural information modernization that databases are built up in provinces then interchanged among them. Each province ought to set up its own practical database for different users to meet the needs of the development of the agricultural economy and scientech in the province. This has to be the focus of strategy for the modernization of agricultural information service at the provincial level. Both the information resources and databases introduced from foreign countries and the ones developed and established by our nation must be considered as powerful backing for the provinces. The national information centers should give the provinces financial support for database construction.

The System of the PCARRD Applied Communication Division in Transferring Agricultural Technology to Farmers

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Introduction

The Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) is a sectoral planning and coordinating council for agriculture, forestry, and natural resources R and D under the Department of Science and Technology (DOST).

PCARRD is mandated to coordinate, support and guide the operation of a national network of research centers and stations in agriculture and natural resources. It puts into operation a mechanism whereby erstwhile independent research agencies, educational institutions and research stations of line departments have evolved into a mutually reinforcing R and D network in the Philippines, called the National Agriculture and Resources Research and Development Network (NARRDN). The NARRDN includes more than a hundred agencies which are independent of PCARRD but their R and D activities on crops, livestock, forestry, farm resources and systems and socio-economics are coordinated, monitored and evaluated by PCARRD.

PCARRD's mandate goes beyond technology generation. Since its inception in 1972, PCARRD has been guided by the dictum "unutilized research results are wasted public investment." It has upheld the truism that research is useless unless it makes a positive impact on the lives of its target users. It therefore recognizes the important role that communication can play in hastening the dissemination and diffusion of research information to its various clientele, most especially the small farmer producer and his family. The technology transfer mission at PCARRD falls squarely on its Applied Communication Division (see Figure 1 for PCARRD's organizational structure).

Concept

Applied Communication is a specific domain under the bigger umbrella of Development Communication or DevCom. While DevCom is the planned and systematic use of communication for the upliftment of the quality of life and human dignity, the focus of applied communication is the communication of research-based information. It is the planned and systematic use of communication for the application of science. It aims

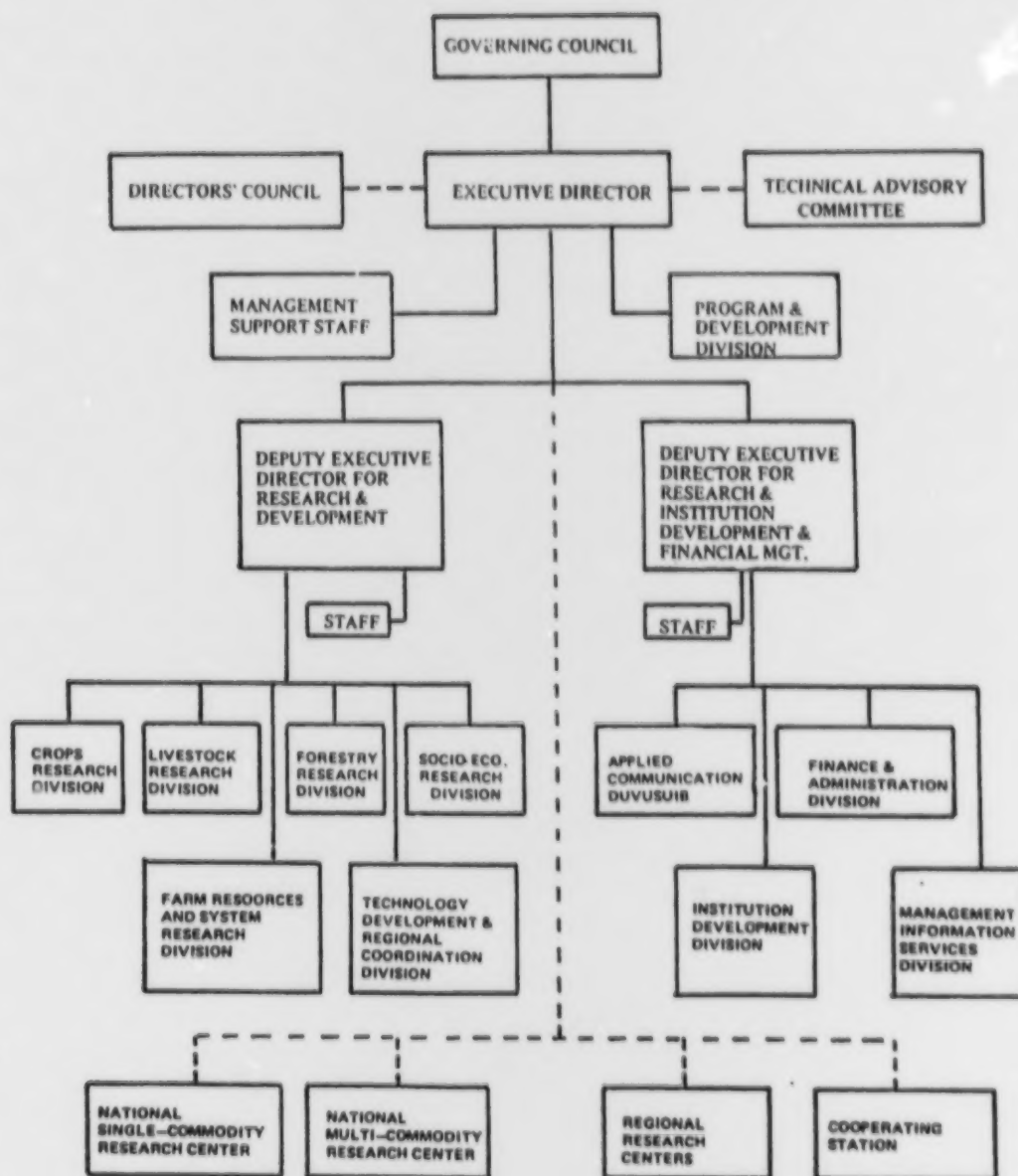


FIGURE 1: PCARRD ORGANIZATIONAL STRUCTURE

at effecting the internationalization and utilization of research and useful indigenous information and technology so that these are integrated into the development process.

The ultimate audiences of applied communication are the small farmers, the rural women and youth engaged in agriculture, forestry, and related industries. Strategies for such communication should provide for the greater participation of the producer in technology generation verification, and the promotion of research and indigenous information. Other target users are the extension workers, researchers, administrators, policy makers, the media, the academe, and the general public.

Objectives

To facilitate research diffusion and utilization, the Applied Communication Division (ACD) specially aims to:

- Bring about effective exchange and interaction about research-related information and indigenous knowledge among farmer-producers, researchers, political leaders, policy makers, administrators, and extension workers so that they may actively participate in the formulation of the national research framework, in priority setting, and in the process of popularizing research findings and technology
- Reach farmer-producers, extension workers, administrators, policy makers, and industry leaders with research information and technology using a variety of appropriate communication channels, modern communication technology, and interagency arrangements and strategies so that they may actively participate in research diffusion and utilization.

Functions

As an outreach and development division of the PCARRD Secretariat, ACD:

- Assists in the study and analysis of problems in research and indigenous knowledge and technology utilization, bringing into the process viewpoints in communication, informal education, institution-building, social sciences, and other behavioral sciences
- Produces print-media outreach materials to disseminate research and indigenous information and technology to various audiences with the primary aim of promoting research utilization
- Promotes the institutionalization of the communication function within a research system through the building and strengthening of a PCARRD sub-network for applied communication in the regions, known as the Regional Applied Communication Offices or RACOs
- Develops applied-communication technology prototypes for multiplication and adaptation by subject matter specialists, as well as by field extension workers and trainers

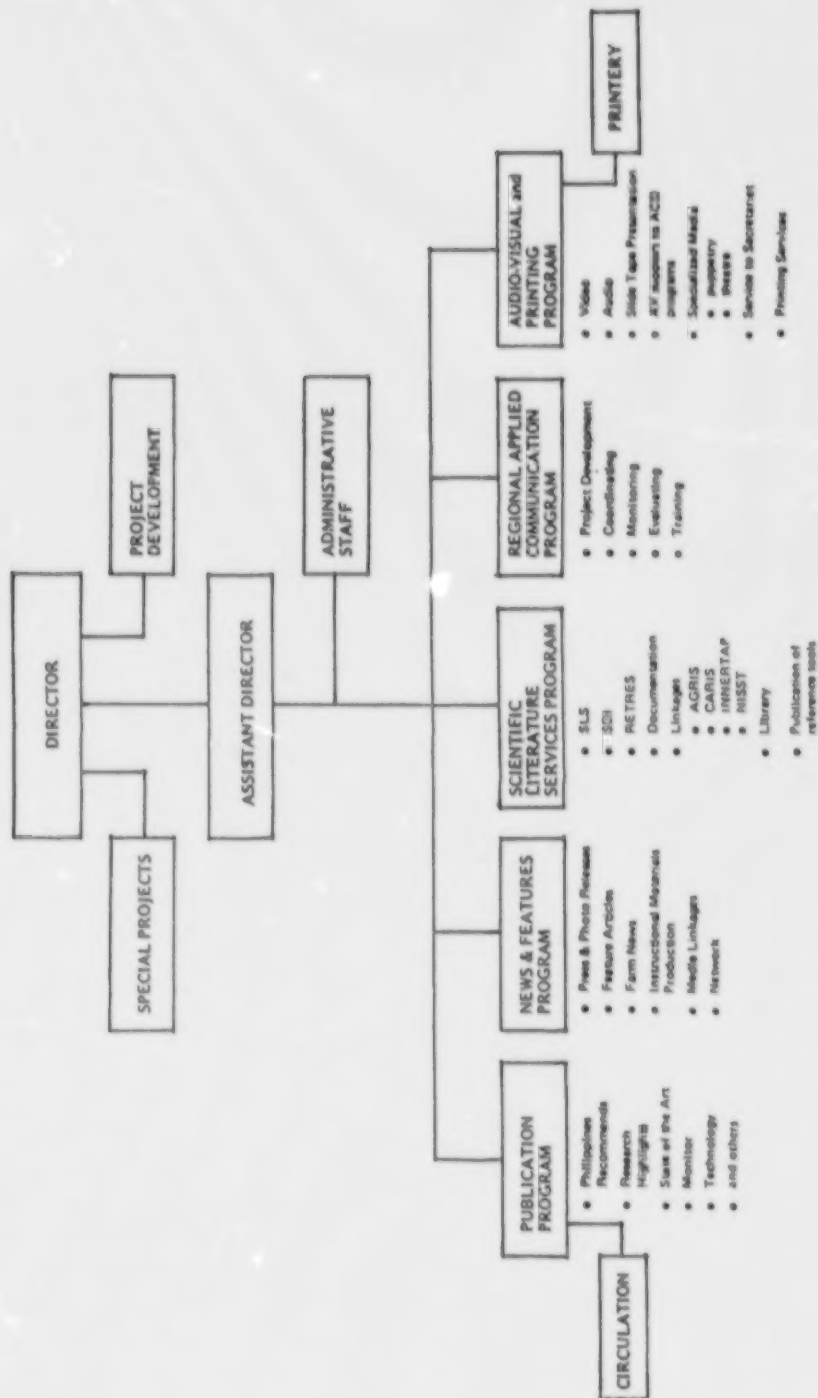


Fig. 2. ACD PROGRAMS AND ORGANIZATIONAL STRUCTURE

- Provides communication support services for the various units of the PCARRD Secretariat - technical editing, publication layouting, publication conceptualization, photographic services, audio-visual and instructional materials preparation, printing, duplicating, scientific literature services, circulation, and conference management.

The ACD development and service mandates cover a wide variety of activities which go beyond the secretariat to meet the communication needs of the regions. Its staff are thereby called upon to perform matrix functions for such activities as training programs in various topics on development communicating for which they provide services as trainers.

Operational Strategies

In order to accomplish its objectives, ACD attempts to:

- Establish interagency cooperative linkages and joint programs consistent with the concept and tenets of applied communication
- Assist the national and regional research centers and consortia in organizing regional applied communication offices (RACOs), developing applied communication programs, training communication personnel, and creating a system of effective communication among the different RACOs to maximize exchange of research information, experiences, lessons, expertise, and resources.

Organizational and Functional Structure

Shifts in PCARRD strategies and directions have made it necessary for ACD to change its orientation and re-align activities with the agency's development mandate. The recent ACD reorganization puts more stress on its outreach and development functions and has restructured the different components into flexible programs which are designed to embrace extension and training within or across programs. The ACD functional structure is shown in Figure 2.

Publication Program

Production

The Publications Program (PP) is one of PCARRD's strengths. It bears directly on its development mandate to have R and D information disseminated to end-users.

Thus far, PCARRD has produced 860 titles/issues estimated at about 1.3 million copies, 90% of which have been distributed free to the constituents of the National Agriculture and Resources Research and Development Network (NARRDN), policy makers, extension workers, enterprising farmers, libraries, the academe, and the general public. Many publications have also been reprinted and distributed through commercial book stores.

The Publications Program engages basically in the production and circulation of PCARRD publications. The editorial staff edits, conceptualizes, proofreads, and coordinates with concerned PCARRD divisions and commercial/private printing presses, and manages the production of the publications from editing to the final stage. PCARRD's fourteen publication lines produced at ACD are the following:

<u>Publication Line</u>	<u>Target User/Beneficiary</u>
1. Book Series	researchers, research managers, administrators, policy makers, communicators
2. Commodity Industry Analysis Series	researchers, research managers, administrators, policy makers, educators, students
3. Data Series	researchers, research managers, agri-business community, policy makers
4. Information Bulletin	R & D network, educators, researchers, administrators, local government officials, extension workers, students, general public
5. PCARRD Annual Report	NARRDN, educators, policy makers, administrators
6. PCARRD Monitor	Policy makers, administrators, libraries, researchers/educators, radio & TV stations & broadcasters, print media, extension workers, farmers, private individuals/corporations, local government officials, students
7. Philippines Recommends Series	Policy makers, administrators, extension workers, researchers, and research managers, libraries, students, agribusiness community, communicators

- | | |
|---|--|
| 8. Research Highlights | Policy makers, researchers, research managers & administrators in the NARRDN and SCUs, communicators |
| 9. Staff Paper series | Researchers, academic community and students, administrators, policy makers |
| 10. State of the Art & Abstract Bibliography Series | Researchers, research managers, administrators, policy makers, academic community, students |
| 11. Technology Series | Policy makers, administrators, private individuals/corporations, radio stations, extension workers |
| 12. Technoguide Series | Extension workers, researchers, farmers, administrators, trainers, communicators |
| 13. Farm News* | Broadcasters, extension workers, farmers |
| 14. Network* | Communicators, RACOs |

*Prepared and produced at the News and Features Program.

Dissemination

Through its Circulation Unit, the Program disseminates these publications to the members of the NARRDN and other target users. For wider circulation, linkage has been established with two commercial book establishments and the Philippine Agriculture and Resources Research Foundation, Inc. (PARRFI) which sells selected titles and reprints to students and other interested parties.

News and Features Program

The News and Features Program (NFP) aims to inform the general public about R & D breakthroughs from the NARRDN and about PCARRD activities and directions through the appropriate media. It is designed to provide a regular flow of communication for general consumption to underscore the urgency of making science and tech-

- Prepared and produced at the News and Features Program.

nology work for the development of the nation and to draw support for PCARRD programs and thrusts.

The Program involves the following media:

Print

In this Program press and photo releases are prepared by the staff from ACD and other PCARRD Divisions. These releases are regularly distributed to major national dailies and local newspapers. Popularized R and D feature articles are also submitted to agricultural periodicals and magazines for publication.

The NFP is also involved in the publication of *Network* - a quarterly bulletin for communication practitioners. Pamphlets and leaflets which are highly illustrated are also produced for farming communities to provide "how-to" materials which are easy to appreciate and understand. Broadcast Studies show that radio listeners consider radio an effective communication medium. It is an inexpensive source of information and entertainment and embraces a wide coverage of listeners. Most Filipino households own a radio set.

The NFP publishes monthly the *PCARRD Farm News* (*Balitang Pambukid* in the Filipino version), a bulletin of ten to fifteen popularized R and D radio scripts sent to radio stations and other users nationwide. Usually translated into the local dialects, *Farm News* articles are aired in the vernacular and sometimes enjoy a regular spot on local radio programs.

The NFP also coordinates the Tuesday time slot of "Paksa 30", a radio program aired daily over DZRB, a Manila-based station, from 2:30-3:00 P.M. Interviews on science and technology are conducted on the air with PCARRD and NARRDN specialists and administrators as resource persons. Another broadcast strategy is the distribution to radio stations of audio tapes of interviews with researchers on relevant agricultural technologies. This is an exchange program initiated through the Philippine Foundation of Rural Broadcasters which has a nationwide membership.

Audio-visuals

Timely and relevant information about the research system is brought to major TV stations in the form of prepared scripts for video releases, video-technotips in fifteen to sixty seconds or one to three minutes, and fifteen-minute video-tape modules developed in cooperation with the Technology and Livelihood Resource Center (TLRC) for distribution to the NARRDN.

Science and technology messages in posters are also designed to provide visual information at a glance, as well as in comics and slide/tape packages.

Interpersonal Communication

Communication is more effectively maximized with the interpersonal approach. The activities include press and feature releases personally delivered to the different media

outlets, invitations for press coverage of special PCARRD events, and yearly press conferences to discuss major R and D issues.

Scientific Literature Services

The Scientific Literature Service (SLS) was established as a facility for effective access to S and T information to serve the research information needs of various types of clientele in the NARRDN. The SLS has a computerized data bank and a total collection of 27,987 volumes of library materials.

Services

Besides library services, the SLS has a current awareness program which provides R and D centers, universities, and colleges with tables of contents of journals and selected articles upon request.

Through the SLS, ACD manages the Selective Dissemination of Information (SDI) project, a computerized system of information retrieval and dissemination of relevant information. The SLS also administers the Research Information Storage and Retrieval System (RETRES), a computerized bibliographic data bank of all completed research, publications, and related literature on agriculture, forestry, and natural resources. The computerized bibliographic information system is capable of generating a listing by author, categorization and subject, type of document and year of publication.

Linkages

The ACD also promotes networking and resource sharing through the establishment of linkages with foreign and local information systems and services. It has been identified as the national center for the Current Agricultural Research Information System (CARIS), a cooperating center for the International Information System for Agricultural Science and Technology (AGRIS) both of the Food and Agriculture Organization of the United Nations (UN- FAO), and an associate center for the Information Network on Renewable Energy Resources and Technologies for Asia and the Pacific (INNERTAP) and the International Referral Network for Environment Information (INFOTERRA).

It maintains PCARRD's linkages with 175 other foreign and local agencies through the exchange of publications which helps augment PCARRD's library collection while it keeps these agencies informed of developments in the NARRDN.

Reference Tools

The SLS publishes seven reference tools to help libraries, researchers, and other users of information.

These publications are, as follows:

RETRES Technical Abstracting Manual

Abstract Bibliography of Research in Agriculture and Natural Resources

*Index to PCARRD Publications**A Directory of Local and Foreign Organizations in Agriculture and Natural Resources**Dictionary of Acronyms and Initialisms in Agriculture and Related Subjects**PCARRD Acquisitions List**Philippine Agricultural Vocabulary**Audio-Visual and Printing Program*

This Program aims to provide support services to the Secretariat in terms of publication layouting; artwork; offset printing; photography; photocopying; and mimeographing services for publications, invitations, etc.; and audio-visual services for conferences, workshops, programs, and briefings conducted by the Secretariat.

This Program also provides matrix services for the various activities of ACD, such as in training and publication production.

Regional Applied Communication Program

ACD created the Regional Applied Communication Program (RACP) to coordinate, and assist the applied communication activities in the regions. The Program has established an applied communication sub-network of fifteen Regional Applied Communication Offices (RACOs) in all thirteen regions of the country.

Functions

ACD provides leadership, coordination, monitoring, training, and project-development support to the different RACOs. It takes the lead in the following activities.

- Assistance in the interagency organization of the RACOs
- Operational planning
- Coordination of inter-RACO programs and activities
- Monitoring and evaluation
- Communication and project management training
- Project development and fund generation

The RACOs have the following tasks:

- To provide communication support to the research activities of the regional research centers/consortia
- To pool the scant communication resources of consortium members and cooperating agencies

- To foster interagency cooperation by providing the venue for cooperative communication work
- To develop and upgrade regional communication capability
- To translate technologies into low-cost, acceptable, and useful communication materials

Activities

ACD coordinates and monitors the six general activities that the RACOs undertake as follows:

1. Publication preparation and production. The RACO takes charge of planning, preparing, and editing publications ranging from integrated center/consortium annual reports and newsletters to fact sheets, leaflets, primers and brochures on practicable technologies.

The RACO is also responsible for developing briefing materials for the consortium not only in the form of print, but also slide-tape packages (STP) and audio-visual (AV) media.

2. Development of instructional materials. The RACO is also responsible for planning, developing, and producing instructional or how-to materials for extension workers and farmers. The instructional materials (IMs) present location-specific technology recommendations in a step-by-step format.

The IMs specifically address the information needs of the farmer and the extension worker; as these also pertain to local sources of planting materials, inputs, credit, markets, and other needed support services. Instructional materials are developed to reinforce training programs for farmers and extension workers. Hence, the IMs facilitate the farmer's application of the technology.

3. Scientific literature service. The RACO is mandated to strengthen the consortium's scientific literature service. The SLS performs the traditional service of informing researchers and students of available literature and procuring photocopies of requested materials from PCARRD.

The regional SLS also retrieves the research reports of researchers and thesis students. This activity is coordinated with PCARRD's national research information retrieval and documentation program.

4. Mass media linkages. Most RACOs are utilizing radio broadcasts and local television programs for technology dissemination by translating technical materials into radio and/or video scripts for different radio and TV formats. The Department of Agriculture, a member-agency in all consortia, utilizes RACO-produced software for the Department's on-going radio programs.

Among the radio formats that the RACOs have developed are schools-on-the-air, developmental radio plugs, radio dramas, radio programs featuring consortium R and D activities, technology breakthroughs, and farmer testimonials.

Part of the RACOs' audio-visual strategies is the revival of appropriate indigenous or folk media in the transfer of technology. Some forms of these are poetry contests, folk singing, theatre, puppet shows, etc.

The RACO is also responsible for putting up consortium exhibits highlighting R and D activities of member-agencies. It also coordinates media-relations activities for the promotion and recognition of the consortium's R and D activities and outputs in the form of news and feature releases for print, radio, and TV.

5. Communication and social action research projects. The RACOs are also being strengthened through project development. Communication research is a vital activity of the RACOs as a mechanism for a continuous bottom-up information flow involving the extension system. By using community media at the grassroots level, the RACOs encourage people's participation in the planning of communication content and approaches. Action-oriented types of communication research are built into their programs. It enables the RACOs to determine people's needs, preferences, and talents so that these become the paramount considerations in planning for communication.

Evaluation research, although not yet vigorously pursued, will be conducted to provide a feedback mechanism for planning and improving strategies toward institutionalization. The RACOs are encouraged to develop and implement applied communication strategies in order to backstop the activities of existing action research projects in the regions/consortia.

One example of an action research project that is now supported with applied communication strategies is the Barangay Integrated Development Approach for Nutrition Improvement (BIDANI) at CLARRDEC in Region III. Some examples of action-research projects which the RACO backstops are the corn research and outreach program in southern Philippines based at CEMARRDEC in Region XII and the verification and standardization of the fish-processing technology project of the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) that are implemented in Regions I, V, and VIII of ILARRDEC, BICARRD, and VICARP respectively.

The above acronyms are names of consortia found in the National Agriculture and Resources Research and Development Network (NARRDN) which is coordinated by PCARRD. (See list on following page.) There are thirteen consortia and two centers in NARRDN. Each consortium is a potent network where the RACO is based. These consortia, either based at the State College/University or at the Department of Agriculture regional office are interagency in nature and work together to bring an operating mechanism into a mutually reinforcing R and D network in the Philippines.

6. Training. Most RACOs continue to organize training and workshops to develop communication skills and technical communication capability of RACO members and ACU (Applied Communication Unit) staff of consortium member-agencies. This is strengthened with the implementation of the combined Department of Agriculture/Agricultural Training Institute (DA/ATI)-PCARRD National Integrated Applied Communication Program in the regions. A number of information/communication officers of member agencies have been trained in instructional materials production and the basics of communication materials preparation such as technical and popular writing, editing and photography.

Conclusion

PCARRD's technology transfer program attempts to provide a systematic and integrated approach for information delivery systems and services aimed at technology adoption and diffusion in all regions of the country through the RACOs. However, there is a continuing need to evaluate the impact that these approaches can contribute to the productivity of small farming systems through development communication research.

THE NARRDN CONSORTIA

1. Highland Agriculture and Resources Research and Development Consortium (HARRDEC)

Benguet State University (BSU)
La Trinidad, Benguet
Cordillera Autonomous Region (CAR)

2. Ilocos Agriculture and Resources Research and Development Consortium (ILARDEC)

Mariano Marcos State University (MMSU)
Batac, Ilocos Norte
Region 1

3. Cagayan Valley Agriculture and Resources Research and Development Consortium (CVARRD)

Isabela State University (ISU)
Echague, Isabela
Region 2

4. Central Luzon Agriculture and Resources Research and Development Consortium (CLARRDEC)

Central Luzon State University (CLSU)
Munoz, Nueva Ecija
Region 3

5. Southern Tagalog Agriculture and Resources Research and Development Consortium (STARRDEC)

University of the Philippines at Los Banos (UPLB)

Los Banos, Laguna

Region 4

6. Bicol Consortium for Agriculture and Resources Research and Development Consortium (BICARRD)

Camarines Sur State Agricultural College (CSSAC)

Pili, Camarines Sur

Region 5

7. Western Visayas Agriculture and Resources Research and Development Consortium (WESVARRDEC)

Department of Agriculture - Region VI

Iloilo City

Region 6

8. Central Visayas Consortium of Integrated Resources Research and Development (CVCIRRD)

Department of Agriculture - Region VII

Cebu City

Region 7

9. Visayas Coordinated Agricultural Research Program (VICARP)

Visayas State College of Agriculture (ViSCA)

Baybay, Leyte

Region 8

10. Western Mindanao Agriculture and Resources Research and Development Consortium (WESMARRDEC)

Department of Agriculture - Region IX

Zamboanga City

Region 9

11. Northern Mindanao Consortium for Agriculture and Resources Research and Development (NOMCARRD)

Central Mindanao University

Musuan, Bukidnon

Region 10

12. Southern Mindanao Agriculture and Resources Research and Development (SMARRDEC)

Department of Agriculture - Region XI

P.O. Box 460

Davao City

Region 11

13. Central Mindanao Agriculture and Resources Research and Development Consortium (CEMARRDEC)

University of Southern Mindanao

Kabacan, North Cotabato

Region 12

14. Palawan Agricultural Research Center (PARC)

Palawan National Agriculture College (PNAC)

Aborlan, Palawan

15. La Granja Agricultural Research Center (LGARC)

Sugar Regulatory Administration (SRA)

La Carlota City, Negros Occidental

Discussion on Functions of Agricultural Scientific and Technical Information in the Development of a Rural Commodity Economy

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Abstract

The demand of rural commodity economy development on agricultural science and technology information (ASTI) under the new situation is discussed completely and a demand system of rural commodity economy development on ASTI is put forward for the first time in this paper. Four principle functions of ASTI are considered to be existing under the new situation according to the demand: the function of decision-making; the function of collecting and transmitting information on agricultural science and technology and the agricultural product market; the function of instructing in agricultural science and technology; the function of evaluating benefits of agricultural techniques. Four proposals for intensifying the functions of ASTI relating to structure, personnel, organization and measures are put forward primarily on the basis of expounding the four principle functions needed to promote the development of a rural commodity economy.

Since the Third Plenum of the 11th Central Committee of the Chinese Communist Party with the deepening of economy system reform and the adoption of an opening policy, the rural economy of our country has progressively gotten onto the track of a commodity economy from a natural economy and product economy and has preliminarily formed a new production pattern and economy operating system with characteristics of planned commodity production. The development of rural commodity production would inevitably stimulate the new function aroused by agricultural science and technology information (ASTI) in order to bring about a prosperous and flourishing rural commodity production. It has an important significance to conscientiously search for and deeply understand the function of ASTI under the new situation of rural commodity economy development for initiating a new aspect of ASTI and for further propelling the rural commodity production forward.

I

Under the new situation of rural commodity economy development, the effective intensification of the function of ASTI depends on the level of understanding of the function, while the function of ASTI under the new situation in the final analysis also depends on the demands of rural commodity production for ASTI. So it is necessary to

seriously search for and bring to light the demands of a rural commodity economy for ASTI before studying and intensifying the function of ASTI under the new situation.

A rural commodity economy is an enormous social economic system containing abundant intentions, it must present various demands for ASTI. Policy-decision demand and concrete practice demand are the two basic demands.

(1) Needs for Decision-making

Decision-making needs here means needs of ASTI put forward by policy makers for developing rural commodity production. According to the range of decision-making, the decision-making needs at present could be divided into macro-decision demand, mid-decision demand and micro-decision demand. Macro-decisions in this paper are decisions for the state or a certain region; mid-decisions involve particular departments of the state or a certain region; micro-decisions are decisions involving a specific production unit like a peasant household or an agricultural production enterprise.

This practice proved that the decision-making behavior related to the whole commodity prediction of state or region, department and production unit exist in the macro-, mid- and micro-decision levels. So the characteristics of a comprehensive ASTI would be produced which would serve for overall decision-making. Of course, decision-making behavior only appropriate in relationship to a certain trade, even in relation to a certain production item in these three decision-making levels also exists, so the demand which served for the decision-making of a certain individual event must be satisfied. Therefore, the overall and individual decision-making demand would also exist in those three decision-making levels. Among comprehensive decision-making demand and individual decision-making demand, consulting demand for consultation, evaluating demand with evaluation as main task and feedback demand mainly for feedback information exist according to the requirements decision behavior to ASTI.

(2) Needs of Concrete Practical Activities of Rural Commodity Production on Agricultural Science and Technology Information (ASTI)

The concrete practical activities mentioned in this paper include not only the rural commodity production activities of production units directly engaged in rural agricultural commodity production, but also the professional activities of certain agricultural administrative departments. The concrete practical activity demand actually consists of an information demand for agricultural commercial production, an instructing demand for agricultural techniques and an evaluating demand of agricultural techniques of benefit in the view of demand content. Three information demands of exploiting new agricultural varieties, new item and market reaction, exploiting new methods of agricultural production and prediction resources, as well as exploiting laborers' quality of science and technology commonly exist at present in the information demand on ASTI of concrete practical activities of rural commodity production. The demand for techniques of instructing on new agricultural varieties, new item prediction and the benefit evaluation of techniques, the demand for technique instructing of new production methods in agriculture and the utilization of production resources and the benefit evaluation of techniques, demand for instructing to improve the quality of laborers in

science and technology and the benefit evaluation are chiefly included in demands of agricultural technique instruction and agricultural technique evaluation. Viewed in relation to various kinds of agricultural production, there are information needs on exploiting new varieties, new item and market reaction, demand on technique instruction and technique benefit evaluation; information demand on exploiting new production methods of agriculture and production resources, instruction technique utilization and evaluation technique benefit; information demand, on exploiting of laborers' scientific and technological quality, demand on instruction to improve the laborers' quality, and benefit evaluation by planting, animal husbandry, fishery, fruit and forestry production among with the demands mentioned above.

It is quite clear that the demands mentioned above summarize the demand expectation and demand behavior on ASTI under the new situation of rural commodity production from various aspects, various levels and various degrees. Thereby, it brings to light an integrated demand system of rural commodity production on ASTI under a new situation.

II

The user-needs analysis of rural commodity production development on ASTI has a significant importance for correctly understanding the function of ASTI under the new situation. Four basic functions of ASTI gradually conformed on the whole to the demand of rural commodity production development after making great efforts by workers of ASTI yearly under the instruction and stimulation of demand.

(1) The Function Served for Decision-Making

Everyone is clearly aware of the fact that decision-making of developing agricultural commodity production would be the first depended on in the development of rural commodity production, therefore, to serve the decision-making process of developing rural commodity production is the first function of agricultural science and technology.

The function of ASTI served for the decision-making has been fully embodied at different levels around three decision-making ranges during these past years.

Taking the macro-range for example, the Information Institute of the Chinese Academy of Agricultural Sciences and other information institutes of local agricultural science academies provided many important and worthy information research reports and related literature at home and abroad for state and local governments to work out a plan in 1980--1985, 1985--1990, as well as developing a strategy until the year 2000, which gave a positive impetus to the final completion of the macro-decisions.

The function is further remarkable in the mid-range. For example, the investigation reports "Study on the Present Situation of Science and Technology Development for Grain and Economic Crops of the Whole Country and Its Prediction" carried out by the Information Institute of the Chinese Academy of Agricultural Sciences which was organized by Rural Developing Research Center of the State Council and "Study on

Prediction of Agricultural Structure Developing Tendency in the Suburbs of Shanghai Academy of Agricultural Sciences" which was assigned by Shanghai Municipal Scientific Committee have been adopted respectively by the State Council and related departments of Shanghai. They are both important for making policy and for implementing the policy. These facts indicate that in the micro-range, ASTI is an important basis for an agricultural production unit or a peasant household to make policy for commodity production under certain circumstances. The leading function of ASTI has been reflected already in instructing the decision-making bodies of the commodity production.

(2) The Functions of Collecting and Transmitting Information on Agricultural Science, Technology and Agricultural Product Market

The functions of collecting and transmitting ASTI are not just produced up to date, but the intention and extension ability of information collecting and transmitting function of rural commodity production, becomes a functional attribute of objective things in all senses.

The functions of ASTI under new situation of rural commodity production are expressed in three aspects. The first aspect is collecting and transmitting information on new agricultural production items, new varieties and the agricultural product market. At present, the collecting and transmitting content and range have been expanded with the development of rural commodity production and the practice of opening policy. Its present characteristics seem that more stress was placed on collecting and transmitting information from foreign countries. For example, a large amount of information on new agricultural varieties, items and market situation from America, Japan, South-East Asia, Hong Kong and Macao were collected, treated and transmitted by the Information Institute of the Guangdong Academy of Agricultural Sciences in order to promote the export of agricultural products and to carry out the policy of trade-industry-agriculture. The second aspect is to collect and transmit information of new production methods and new means of production. A typical case was made by the Information Institute of the Jiangsu Academy of Agricultural Sciences and the Zhejiang Academy of Agricultural Sciences which collected and reported a large amount of information during these years on new equipment, new techniques of agricultural production or by-products processing and made great contributions toward the development of rural agricultural products or by-products processing. The third is to collect and transmit information on exploiting the quality of science and technology of rural commodity producers. For example, the periodicals *Shanghai Vegetables*, *Edible Fungi*, *Shanghai Agricultural Science and Technology*, etc., edited and published by the Information Institute of the Shanghai Academy of Agricultural Sciences report typical information of rural commodity producers on how to effectively master the commodity production activities through studying the cultural knowledge of science and technology, improving producers' quality and consciousness of science and technology which resulted in stimulating the creativity of producers engaged in the same products.

(3) The Function of Instructing in the Knowledge of Agricultural Science and Technology

Under the circumstances of transformation from a natural economy into a commodity economy and sharpening competition in the commodity market, the development of rural commodity production depends more on technique progress than before. So the expectation by rural commodity producers to obtain agricultural science and technology is inevitably stronger. During these years, in order to adapt to new conditions, emphasis was laid on providing and instructing in science and technology for rural commodity producers by ASTI institutions at different parts of our country by making use of ASTI. The information institutions, in addition to transmitting and instructing agricultural knowledge of science and technology with periodicals and magazines, also provide and instruct the rural commodity producers with agricultural science and technology information by editing or publishing adaptable technical books and materials and by setting up technical training classes. For example, the Information Institute of the Shandong Academy of Agricultural Sciences and the Information Department of the Shandong Agricultural College edited or published a series of technical books and materials such as *Feeding Technique of Angora Rabbit*, *Raising Technique of High-Yielding Fish*, *Technique of Developing Garden Economy*, etc.

The Information Institute of the Shanghai Academy of Agricultural Sciences brings the instructing function of ASTI into full play by tapping the latent powers of technique instruction, setting up correspondence classes on techniques of edible fungi production at the same time as placing an emphasis on instructing techniques through periodicals, books and other materials.

(4) The Function of Benefit Evaluation of Agricultural Techniques

The evaluation of benefit of agricultural techniques is a new demand on ASTI under new situation of rural commodity production development, it is also a new function produced by ASTI.

It is mentioned above that the competition of commodity would be sharpening under new situation of developing a planned commodity production. The competition of commodities is actually a commodity quality competition or a technique benefit competition. In today's "information explosion," related techniques emerged in large numbers. The demand on ASTI departments is to carry out essential evaluations of good techniques, especially the evaluation of economic benefits of techniques (including the evaluation of applied conditions) simultaneously with the extensive collection of related techniques in order to recommend adaptable optimum techniques to rural commodity producers. With the increase of demand these years, the work mentioned above has been somewhat developed. The function of evaluating technical benefits by ASTI is reflected correspondingly progressively. For example, the Information Institute of the Fujian Academy of Agricultural Sciences has launched a service of information in kind and carries out benefit evaluations of new agricultural product varieties, agricultural technique utilization using information in kind of agricultural products. The technical information in kind with outstanding techniques for economical benefit has been provided for the rural commodity producers in the province

through evaluating selected information in kind. The Information Institute of the Shanghai Academy of Agricultural Sciences, on the basis of systematically carrying out evaluations of each technique benefit of new technical measures in animal husbandry production on the Shanghai seacoast district combined with a study on related subjects, has selected and recommended several technical measures with optimum economical benefits suited for use under various conditions.

III

The present situation of science and technology information that is inadapted to the planned commodity economy is still comparatively grave; this is indicated by *The Summary of a Forum on Reform of Science and Technology Information System of the Country*. Therefore, it is obviously an important way to change this situation by taking effective methods and intensifying the function of ASTI after analyzing the function of ASTI under the new circumstances. It is complicated to intensify the function of ASTI under new situation. The intensification must be a comprehensive measure for various aspects. We all considered that the structure, qualified personnel, organization and measure are the principal or fundamental contradictions which should be settled.

(1) Improving the Structures within Agricultural Science and Technology Information Institution

The functions, strong or weak, depend on the structural differences and the structure is guaranteed to be a reflection of function which is indicated by Puligoin, a famous scientist in Belgium in his dissipative structure theory. Thereby, the first to be improved is the structure within ASTI institutions in intensifying the function of ASTI. According to the demand of rural commodity production development and the developing tendency of functions about ASTI, we considered that the structure construction within an ASTI institution should be beneficial to the information exploitation serving for decision-making and technique benefit evaluation, to the information utilization served for technique instruction and the basic construction of information served for collecting and transmitting information. A structure with three principal pillars—information investigation, technique reporting and instructing by periodicals, books and literature has been formed progressively.

In the light of present conditions, it is necessary to continually adjust the structures within information institutions of agricultural science and technology, to intensify and perfect the information investigation institutions. At the same time, it is also necessary to change and adjust personnel composition and the intellectual composition of the information institutions of agricultural science and technology, to increase personnel in specific fields such as agricultural information investigation and agricultural economy. Under the conditions of limited internal financial resources, practical and effective measures should be worked out to encourage these institutions to increase service such as by improving serving quality, expanding their social influence, searching for social support, opening all financial resources, expanding or developing actual strength and speeding up development in order to be suited for the development of rural commodity production.

(2) Training T-Type Personnel of Science and Technology Information Integrated with Economy

After the functions and structures have been determined, the personnel is a decisive factor. In view of the intellectual composition of ASTI ranks and personnel at present and the daily increasing demand of rural commodity production on science and technology information integrated with economics, the pressing and important task facing agricultural information field is to train T-Type personnel in science and technology information integrated with the economy.

The following guiding principles for training T-Type personnel specified in information-economy should be adopted. The first aspect is to inculcate the information workers in-service, especially middle-aged and young information workers with economic knowledge. Necessary measures must be worked out to arouse their enthusiasm for studying economics and to widen their knowledge at the time of providing studying conditions for information workers in order to greatly change the knowledge composition of the information workers in-service on agricultural science and technology in a comparatively short period. Second, much attention must be devoted to training T-Type information workers for the future.

Therefore, the Information Institute of the Agricultural Ministry is proposed to prepare for constructing or establishing an Information College of Agricultural Science and Technology in China. Except for training personnel in information techniques and information management in-service, it would emphasize training information personnel for the future and building up T-Type information personnel in agricultural science and technology with knowledge of both information and economy.

(3) Intensifying and Perfecting the Information Network of Agricultural Science and Technology

We noticed that some distance still exists between the present information capability of agricultural science and technology of our country and the intensifying demand for information functions on agricultural science and technology. The distance will not be changed greatly within a short period of time. Under this circumstance, an effective measure to shorten this distance is to develop an information network of agricultural science and technology, to extensively exchange and cooperate in ASTI, to jointly enjoy information resources. After the meeting in Liuzhou in 1977 which put forward a proposal to establish an agricultural science and technology information network throughout the country, information cooperation networks have been set up in Shanghai Economic District, East China, North-West China, North China District, and significant effective results have been obtained by cooperating in carrying out the activities of information exchange. But some problems still exist. By taking a comprehensive view of information networks of ASTI all over the country, the major problems are that the information networks have not been set up everywhere, the established information networks fall short of instruction and help, they are also restricted by conditions such as being short of funds. So the above mentioned problems limit bringing the effect of information networks into full play. In view of the above mentioned facts, we wish to make the following proposals: the Information Institute of

the Agricultural Ministry and the Information Bureau of the State Scientific Committee should pay further attention to perfecting and constructing information networks for agricultural science and technology, they should intensify the instruction works of agricultural information networks at all levels and provide the requisite funds for information networks. In addition, a proposal is also put forward to start a special column "Information Networks Dispatches of Agricultural Science and Technology" in the periodical *Information Works of Agricultural Science and Technology* in order to push forward the development of information network organization over the whole country.

(4) Speed Up the Modernization of Information Service Methods of Agricultural Science and Technology

Based on the functional demand of ASTI and present conditions permitting, the following works could be carried out in modernizing the construction of information service methods in agricultural science and technology.

According to the understanding that quantity and accuracy are important bases for the scientification and modernization of research work, we feel that the present information research method based on formal logic and conventional quality analysis should be transformed into advanced research methods which combine formal logic with mathematical logic, combine qualitative analysis with quantitative analysis, establishing a mathematical model to carry out simulated operations on a computer, in order to draw a scientific conclusion combining qualitative analysis with quantitative analysis to suit the needs of rural commodity production development.

On the aspect of periodical reports, in order to further improve the technical instruction quality of periodicals on ASTI, intensify the reporting of suitable techniques and technique instruction. The micro-technique and computer disc storage technique are adopted to set up a pool of data on adaptable technique consultation and technique information exploitation, to carry out adaptable technique consultant service and to provide information on science, technology and market for rural commodity producers on the basis of opening up and expanding information resources according to the characteristics of special periodicals. In the modernization construction of books and materials, we should first pay special attention to the standardization of subject indexing and searching, to lay a solid foundation for establishing a computer search system of literature in common use. At the same time, identification, copy and production, popularization and training in how to use computer software are carried out actively for literature input, treatment and searching. For speeding up the construction of a computer search system for publications and materials, the Information Institute of the Agricultural Ministry is proposed to prepare for the construction of a disc exploitation and production center for agricultural literature in Chinese to make a great contribution to rural commodity production development through instructing, helping and pushing forward the modernization of literature and materials searching in agricultural information institutions in different parts of our country.

Intensifying the information function of agricultural science and technology under the new circumstances of rural commodity production development is an important project for conforming to the new trend of rural commodity production development. It could be expected that, as this project progresses, it would produce a powerful driving force for the development of rural commodity production and stimulate the development of the rural commodity economy of our country.

Information as an Economic Resource in Agricultural Development

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Abstract

The most striking development in recent years has been the widespread acceptance of information as an economic resource in agriculture development just like land, labor, capital and entrepreneurial skill. This shift is bigger than any changes in politics, government or economics in many developed countries.

Information used to be looked upon as an ornament rather than a necessity. Malaysians, quick to recognize the power of information, are already beginning to pay special attention to it in its use for planning and decision making in agricultural development.

The increasing awareness of information as a resource in the development of agriculture is reflected by the commitment and investment directed at information generation, processing and packaging, and dissemination in Malaysia.

This paper examines the changing perception of the importance of information in the development of the agricultural sector in Malaysia. In the discussion of this issue in relation to information generation and management under the local environment, the emerging global trends on the same and their accompanying challenges are also addressed. The need to develop information into a strategic and economic resource for development, in general, and agricultural production, in particular, is highlighted.

Introduction

The agricultural and industrial revolutions which took place during the 18th century brought about tremendous progress in agricultural and industrial productivity and efficiency to the world. The world has not stopped changing and moving ahead since then. As a matter of fact, it is changing at a much faster pace than one can notice. The changes that have taken place were so rapid that we have already advanced into a new era without being noticed by many of us. The information revolution is already in our midst and is impacting every aspect of our lives. This shift, by itself, is envisaged to bring about more changes to the world compared with those caused by the agricultural and industrial revolutions put together.

The information revolution has brought with it an information explosion which has been referred to by some as information pollution. It has been estimated that the

world's information is doubling every three to four years, whether it is business, education or in the home (Poppel and Goldstein, 1987). This geometric progression in information generation is increasingly overwhelming to information managers in general and users in particular. These trends are posing new and mammoth challenges to information generators and managers under an environment of decreasing financial resources for their management. The new challenges arising from this development have been summarized by Minnick (1989) to be as follows:

- the need to transfer more information to more people in less time if we are to keep up with new ideas,
- the increasing complexity in information with advances in science and technology,
- the need to share information with cultures of different languages,
- the need to improve communication between people of different disciplines,
- the need to transfer complex information to a younger population to prepare them for a technological society, and
- to develop and provide appropriate information to retrain older adults in order to keep them abreast of new techniques.

Quest for Information

The increasing demand for appropriate information for project planning and implementation, and decision making in agriculture development is becoming more evident in Malaysia. This has been brought about by the modernization of Malaysian agriculture and the increasing awareness of information power and its rapid transmission to users through improved media and communication. The new farming community in this country is also better educated and as such is more receptive and responsive to new and improved ways of doing things. The latter is basically information appropriately processed and packaged in a form and content relevant to the real needs of the farmers in terms of timeliness and locations and even size of their operation. This quest for information is real and having to respond to the challenge seriously is crucial to further improve the productivity of our farms and the efficiency of the farming operations.

The continuing quest for the right type of information is essential for any business to maintain its leading edge. Malaysians are aware of this and this has been fundamental for the country to remain a world leader in rubber and palm oil production. Making information work for us and merging it with our experiences and judgement has enabled us to stay ahead and continue to forge forward in a continually changing agricultural business environment. In this context, the need to harness the tons of information available and distill them into a strategic and economic resource is becoming even more pressing. Considering that we are living in a world of increasing competition and in the face of depleting natural resources, the development of information into an economic

resource for agricultural development must be aggressively pursued and the quest for this resource intensified.

Awareness of information power

In order to appreciate the power of information, one has to be aware that harnessed information provided at the right time and applied with a clear objective in mind is capable of increasing productivity and efficiency, relieving manpower pressure and sharpening the competitive edge.

The importance attached to information as an economic resource in agricultural development in Malaysia is reflected by the huge sum of money allocated for agricultural research and development. For example, 1,103.6 million ringgit (ca. US\$408.7 million) have been allocated to the Malaysian Agricultural Research and Development Institute (MARDI) for the period 1970-1990 to conduct research and development in agriculture. MARDI's commitment to this national call for information generation and development is evident in one of its functions embodied in the MARDI ACT, 1969, i.e., "to serve as a centre for the collection and dissemination of information, and advise on scientific, technical, and economic matters concerning the agriculture industry including the publication of reports, periodicals and papers thereto."

Information as a resource

In approaching the development of information into an economic resource, the following aspects should be taken into consideration:

- information generation
- information development and dissemination
- information storage and retrieval

In addressing these, it is critical for us to pay special attention to the real information needs of the users. It is equally important for the information to be processed and packaged into a clear, and easy-to-use form that is consistent with users' needs in terms of content and timeliness. The challenges posed by Minnick (1989) are also pertinent to this topic under Malaysian conditions.

Information generation

The creation of information/knowledge, by itself, has no immediate economic impact. It only becomes a major component for economic progress when it can be turned into a source for innovative process or decision. For this to happen it is most important that the real information needs of the users are understood. In the generation of appropriate technology for a farming community, we must be guided by specific objectives formulated and based on its relevance to the problem(s) intended to be solved. Unfortunately this approach to information generation tends to be the exception rather than the norm. This is reflected by the reported publication of some seven thousand scientific articles every day. We appear to be building an information maze, one which our farmers enter

and get lost in the process. The more information we generate, the more complex the maze becomes and we are no better off than before.

In view of the above one wonders whether these publications have been produced for the sake of publishing, or they merely lack a focus on the intended results and/or they simply do not know how to reach their intended clientele. The other possible reason is the total lack of awareness that information can be an economic resource for agricultural development.

Whatever the reason, a developing country like Malaysia can ill-afford the luxury of generating and publishing information for its own sake. With increasing limitations on the resources allocated for research and development, the world at large must also awaken to this folly and take the necessary action to ensure that the information it produces is truly useful and beneficial for development purposes.

Year	Quantity (000 t)	Value (000 M\$*
1984	15.13	3,430
1985	11.52	2,960
1986	11.21	3,370
1987**	21.84	6,130
1988	23.69	11,930
1989 ***	35.54	17,895

*M\$ = Malaysian dollars or ringgit (US\$1 = M\$2.7)

**Technology for production of Eksotika papaya was released by MARDI.

***Provisional figures.

Table 1. Export of Malaysian Eksotika Papaya (Chan, 1990)

The Eksotika papaya project, carried out by MARDI, is a good example of how information generated with well-defined objectives at the onset can contribute to national development and bring in more foreign earnings for the country. The project which was initiated in 1972 had as its primary objective developing a technology for the production of papaya for the catering and export markets. When the technology was released in 1987 by MARDI, it was well received by the farming community and the produce by the terminal markets. This is reflected in the 5.2 fold increase in papaya export value in 1989 compared with that of 1984 (Table 1).

Another good example of the usefulness of information as one of the resources for agricultural development is evident in the progress of the Malaysian cocoa industry. The single mindedness directed at cocoa production research and the application of the latest technology especially in the plantation sector, to the growing of this crop has

made Malaysia the third largest producer of cocoa in the world after the Ivory Coast and Brazil. This has taken place during the last ten years with the dramatic run-up from 1985 (Table 2).

Year	Production (000 t)
1971	4.0
1972	5.0
1973	9.0
1974	10.0
1975	13.0
1976	15.4
1977	16.7
1978	17.7
1979	26.8
1980	36.5
1981	45.2
1982	66.2
1983	69.0
1984	88.0
1985	108.0
1986	132.7
1987	185.0
1988	220.0
1989*	255.0

*Provisional figures.

Table 2. Cocoa Bean Production, Malaysia (1971-1990)

Information development and dissemination

The mechanism of information transmission in relation to the information generators or researchers would affect the usefulness of the technology produced. According to Havelock (1971), there are three models of information systems, viz., (a) research, development and diffusion, (b) social interaction, and (c) problem solving. The first two models are top-down approaches and only permit a one-way flow of information with no scope for interaction or dialogue. The information users' needs and problems are normally not taken into consideration in the creation of information. These are still the primary models for agricultural systems in many developing countries.

The problem solver model begins with a felt need and the information generated is usually tailored for a specific purpose. The result always ends with a satisfaction of that need. The focus is on the users and their information needs for increasing agricultural productivity and efficiency. This process can produce the right information and have it developed into an economic resource because it involves collaboration, interaction and communication among researchers, extension specialists and farmers.

The flow of information to the farming communities, the nature and sources of information and the manner in which it is processed, packaged, targeted and disseminated would also affect the impact of it as a resource in agricultural development (Heong, 1989). Information must be presented in a clear, easy-to-use form consistent with the users' needs.

It is important to know and understand how information is received by the users in the knowledge system in order to close the reception gap. Information reception by the users may be impeded by its inappropriate transmission or it may be in a form too abstract to be understood by the farmers (Cabanilla and Hargrove, 1987; Escalada, 1987).

The tailoring of information to particular target groups will facilitate the narrowing of the knowledge gap (Adhikarya and Posamentier, 1987). Materials for transmission to the farming communities should be pre-tested and accordingly revised to ensure that the right message is conveyed. Messages can be easily misinterpreted because of gaps between the information processors and the targeted clientele. For example, a poster of a farmer with a sprayer and bottle may convey the message that chemicals need to be applied rather than the intended message (Escalada, 1987).

Information storage and retrieval

Traditionally, libraries have been looked at as storehouses of books rather than vendors of information. With the increasing quantum of information generated, published and stored away, a scenario of the information explosion has occurred. As a result, the problem of accessing relevant information is growing in staggering proportion with time. The Malaysian Agricultural Research and Development Institute (MARDI) is embarking on a program, to transform information that it generates and acquires into an economic resource during the Sixth Malaysia Plan period (1991-1995). The library component of it is to ensure that the information it holds can be readily retrieved when one needs it and in the right format.

The challenge to develop a 'new library' is not to think of it as a physical but rather an electronic source of information (Lee, 1989) which can connect users with an international network. If it is to play a useful role as a provider of information, it should no longer be a physical depository of materials but a 'virtual gathering,' where the actual materials can be dispersed all over the world and accessed through an electromagnetic medium.

The future library would work as an information exchange where it will point to where information can be retrieved. In principle, it need not keep all the primary information media like books, journals, and microfilm. Rather it should be able to know the exact locations where specific items of information can be found (Lee, 1989). This approach to information storage will allow for an increasing quantum of it to be stored without physical library space becoming a constraint. This is most heartening in view of the decreasing funds available for construction of new and bigger library buildings and the harnessing of the information explosion which is occurring in geometric proportion. The storage of information in an electronic medium will also allow it to be systematically accepted or rejected, and shifted or transformed in order to have value added to it. Information in this form can be quickly reordered and distributed according to need and its optimal use. In the same way, it can be readily retrieved and in the form needed. The timeliness with which the information can be made available can thus make it a strategic resource which can play its role effectively in the economic development of a country.

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Scientific and Technological Information is a Potential Productive Force

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Abstract

The author thinks that producing scientific and technological information is a kind of public welfare service. According to its formation, development and role, information work has its own regular pattern, characteristics and social division of labor. In order to strengthen the social function of scientific and technological information work, the traditional closed working model should be changed to adapt to the development of a commodity economy. The reforms of the scientific and technological system and economic system and the development of a planned commodity economy will certainly result in market competition of commodities. Of course, the substance of commodity competition is the competition of information and technology. Therefore, while making a thorough on-the-spot investigation, the author tries to capture the new, mobile and sprouting information and to study it in order to make judgments and forecasts. Also, the author tries to change the work of information from a single factor service to a comprehensive service, from a static service to a dynamic service, and from a closed service to an open service.

A

Science and technology should face further economic construction, while the economy will further rely on the progress of science and technology. Both of them need deepened reform. And at the heart of reform is how to combine science and technology with economic construction. We know that the need of the economy and society is the strong power to push the development of science and technology forward. Only when combined with the economy, will science and technology display their value and function and develop rapidly. Since the readjustment of the rural industry structure, farmers have become rich due to policy, intelligence and technological information instead of policy and manual labor. Therefore, information workers should actively provide them with rapidly-effective, high-efficiency technological items and new products which will be simply produced with a big market, and also with various new, high quality seeds or animal varieties. All of these works talked about require information service to penetrate these areas of technology, economy and marketing. In recent years, we have provided information in the areas of the economy, technology and market for more than eight counties including Ruijin, Nankang, Fengxin, Dean and Xingzi, etc., in Ganzhou and Yichun prefectures. We have also edited 18,000 pieces of applicable techno-information. We have held 680 training classes on various types of technology in which some 98,000 technicians have been trained. According to incomplete statistics,

these works have gained an economic efficiency of 0.264 billion Yuan. Among them are the technique of transforming "little old orange trees" and the extended application of the plant growth regulator PP333, which have resulted in remarkable economic and social efficiency. These techniques have been widely welcomed and praised by farmers.

B

In order to strengthen the social function of information work, raise its efficiency and the quality of information products, and quickly transmit information in order to improve its aim, adaptation and effectiveness, we must firmly establish three ideas: "customs' requirement is our first need," "scientific and technological information are potential productive forces," and "serving the people." We also need to make information a connected sequence service of technique, and production.

To achieve a connected sequence of service, the usage of a library is limited. So, a strong team consisting of part-time information specialists who specialize in one area of technology should be organized. Therefore, based on public recommendations from different departments (or specialties), the information department formally engages those persons recommended as part-time information specialists in order to push the information work forward. Our concrete methods are summed up as follows.

1. Reforming the traditional idea of waiting for customers of information, firmly establishing the new idea of customers first.

In the past, library information only positively served the university leaders for decisions, teachers and scientific researchers. If someone suggested that information should face economic construction and serve social production, he would have incurred blame for not attending to his proper duties. We had discussions about what was the central task of scientific and technological information. Later we all realized that information is an important component of science and technology. The central task of agricultural science and technology is to contribute to economic construction and to the vigorous development of the rural economy. Because of the same understanding, we organized a very capable team to go out from the university to make a thorough investigation in the rural areas. Because of the reform of agricultural structure and farmers' enthusiasm to get rich, never before have science and technology been so welcomed and needed in the rural area. But now the countryside is too closed to get any science and technology because of mis-information. For example, orange farmers in two areas, Zeqian Xiang and Shujiadang Xiang in Xinzi County, had planted 30,000 orange trees which were eight years old but had never flowered and fruited. Generally, an orange tree will bear fruit after five years of transplanting. So, these farmers were very anxious. We informed our fruit-tree professors of the situation. The professors diagnosed the case as problems of the farmers' pruning technique. The orange farmers did not know how to properly prune orange trees. Vegetable branches grow more vigorously than fruit branches. When orange trees flower, the flower buds and young fruit do not get sufficient nutrients, so they drop off in large numbers. Therefore, the trees only flower without any fruit. The nickname of "little old orange trees" was formed as the result.

In view of this situation, we invited the professors in the Horticulture Department of our university to hold a training class on orange pruning on the 5th of January in 1988 of the lunar calendar in order to avoid missing the farming season of field crops. Although the weather was very cold, orange farmers attended the five-day-long training class with enthusiasm. Only fifty persons were invited to attend, but 78 were present at the class. The farmers said that, they like this kind of training class and they need such applicable techniques. As a result, the 30,000 unfruitful orange trees flowered and bore fruit. In 1988, the yield of Wenzhou honey-oranges generally went down by 30 to 50 percent because of natural disasters. But the 30,000 trees in this rural area increased their production of oranges by 110,000 kg, amounting to 200,000-220,000 Yuan RMB.

The transforming technique of "little old orange trees" has also produced good results in Xinjian County, a suburb of Nanchang City. The per unit area yield of oranges has increased from 112.5 Kg to 3,000 Kg per hectare in 1982 resulting from the transformation of little old orange trees. And the per unit area yield continued to rise. By 1986, the average per unit area yield in this county reached 15,457.5 Kg per hectare.

2. "Activating" information resources and strengthening the consciousness of information.

Our department has widely collected the information on PP333 for many years. This is a new type of plant growth regulator which possesses multiple efficiencies such as stunting the growth of many crops, promoting branching or tillering, and raising resistance. Its application was reported in China and abroad. But no one asked for the information. When we learned that the plant physiology teaching and research group in the Agronomy Department was carrying out research on the efficiencies of PP333 on crop physiology and crop yield, we actively cooperated with them by supplying information service. Through manual searching, machine searching, computer searching and substituting searching of CAB magnetic tapes, we have supplied more than 2,800 pieces of information about PP333. We have also copied 402 original works. As the researchers of the plant physiology teaching and research group commented, "You acted as a catalyst in urging the application of PP333 on crop production."

The application of PP333 in raising late-cropping-rice seedlings was listed as an important national research project during the 7th-five-year period of China. It was a special subject of the research of "chemical regulation on crop growth and development." During the period of raising late-cropping-rice seedlings, the climate is very hot and humid. The seedlings grow so rapidly that they are very tall and very tender. When they are transplanted, many leaves of the seedlings become yellow or die back very seriously. And it takes a long time for the transplanted seedlings to become green again and to tiller. So the growing season is delayed and grain yield decreased, as a result. The problem was not solved until the application of PP333 during the period of raising rice seedlings. For instance the application of PP333 made notable results in Xinzi County. In 1986, the experimental and demonstration area of the application of PP333 on raising late-cropping hybrid rice was only 0.9 hectare, but the results showed that PP333 had a remarkable effect on raising rice yield by stunting the seedlings growth in hybrid rice and urging more strong tillers. Therefore, the demonstration area increased to 2,134

hectares in 1987 from the 0.9 hectare of 1986. Nearly forty percent of the planting area of late-cropping-hybrid rice or 31 percent of the total late-cropping-rice area had been applied with PP333. Results showed the yield per hectare increased by 405.3 kg. This county increased its rice yields by 970,000 kg amounting to 427,000 Yuan RMB, being 19 times of the cost of PP333. In 1988, the Xinzhi County widely spread the use of PP333 in rice grain production.

We reported these results in the *Jiangxi Scientific and Technological Paper* to further strengthen farmers' consciousness of information. A few days after our report, more than 100 letters from farmers asking for consultation and for buying PP333 were seen on our tables in the office. We supplied 409 pieces of information and consulted with 188 persons.

Those who have applied PP333 on raising rice seedlings since 1987 realize that PP333 has a good effect on raising strong seedlings and increasing rice yields. Someone in the agriculture department of the government even exaggerated that the application of PP333 was a best agri-technique since the liberation of China in 1949. In 1988, the rice area demonstrating the application of PP333 was over 400,000 hectares. It was 1,334,000 ha in 1989. If the PP333 had been applied in the total 2,600,000 ha of rice area, it would have led to an increase in rice grain yield of a billion kilograms. Just thinking the cost of 9 yuan RMB for PP333 per hectare and 6 yuan RMB for labor to apply it, what a huge profit and social benefit!

3. Firmly carrying out the idea of serving agricultural production with all our hearts.

Agriculture is a very important industry in China which employs 800 million farmers. Therefore, we should carry out the idea of serving agricultural production with all our hearts. Since 1986, we have organized 800 person-times of teachers and 12,000 person-times of students to carry out scientific services in the countryside. We have also supplied more than twenty counties with scientech service items. We have trained 13,000 persons at different levels. All of these have produced 60 million yuan RMB of economic efficiency.

We also have supplied farmers with free scientific and technological information about crop production, animal husbandry, processing of agricultural produce and rural industry during the recent years. We have edited and printed applicable technique information and have been deeply praised by farmers and plant managers. A rural family specializing in rice production in Nanchang City commented in their letter, "You are the most honorable and trustworthy persons because you serve the farmers with all your hearts...."

C

Through our experience in recent years, we really realized that as a public welfare service unit, the aim of an information department is to serve the society with all our hearts. But it does not exclude services requiring payments. The quality of service

depends on its social effect. Experience has told us that it is not sufficient for the workers of scientific and technological information to supply farmers with only information services. Therefore, how to raise the farmers' capacity for culture, science and technology becomes our unshakable duty. We actively cooperated with the Agriculture Correspondence Institute of Jianxi Province, and we held information training courses for the correspondence students. We edited textbooks and information books on applicable rural techniques. All of our efforts have gained notable social efficiency. For instance, there were 3,000 young farmers who attended the correspondence institute in Yongxin County. Now, eighty percent of the correspondence students have become key agriculture technicians through testing. A correspondence student, Tang Yuza, at Jiuxichun in this county, planted mulberry trees to raise silkworms with proper techniques, gaining a net income of 20,000 Yuan. Then he was elected as a demonstrating member of science and technology. Following the demonstration he made, all of the thirty families in his village planted mulberry trees to raise silkworms. Two thirds of them got a net income of more than 5,000 Yuan a year. The local farmers praised, "The correspondence institute, with no walls and no building, gives wings to us to get rich."

The "soil" in which the scientific and technological information exists, develops and becomes strong comes from the care of different departments of society. Only as the small, thin flow of information penetrates into different departments of society, and every citizen has a strong consciousness of information and realizes the need for information, will the flow become a magnificent social flow of information. The ultimate aim of the information department is to enrich people's idea of information, to help them master modern information media and to advise people to fully use information resources in order to promote economic construction.

Integrated Root Crop Program (Philippines): A Coordinated Approach in Research Development and Extension

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Abstract

This integrated program was developed with a coordinated approach in research and development, and extension. Coordination is carried out in a multi-agency and multi-disciplinary approach and personnel involvement in the program. There are three distinct components of the program: i) integration, evaluation and training; ii) production, animal feeding and processing; iii) enhanced access to appropriate root crop technologies. The formulation of the Program Core Team (PCT), a review, coordination and training body that provides a forum through which issues and mechanisms of integration can be worked out is perhaps the more innovative component of this program. Its functions include integration and coordination, evaluation, planning and human resource development.

Research and development for production, animal feeding and processing includes multi-agency and multi-disciplinary involvement of personnel to take charge of root crop improvement, processing, and utilization of root crops for animal feeds and human food which would directly benefit subsistence households.

By enhancing access to appropriate root crop technologies the program aims to develop a participatory and integrated extension program that will accelerate the adoption of appropriate root crop technologies by subsistence householders. The components include: inventory of root crop technologies; socio-economic survey; consumer study; identification of target groups; statistical databases; extension training program; communication plan and strategies (media-mix, content and format) of extension support materials; piloting; production and dissemination of extension support materials; feed-back mechanisms and processing documentation.

INTRODUCTION

Research and development and extension projects on root crops in the past were conducted individually on a piecemeal basis -- unintegrated and uncoordinated.

Previous IDRC support on various projects while focusing on root crops has been lacking close integration and coordination of the projects. On the suggestions of various IDRC program officers but coinciding with a desire by ViSCA for closer integration of root crop research, ViSCA has integrated their requests for root crop support into a coordinated program.

BACKGROUND

The Philippine Root Crop Research and Training Center (PRCRTC) based at the Visayas State College of Agriculture, (ViSCA) Baybay, Leyte, was established with the Philippine Council for Agriculture, Forestry and Natural Resources, Research and Development (PCARRD) and IDRC support in 1978.

It is now one of the leading root crop centers in Asia. In addition to IDRC support, it has also received financial assistance from ACIAR and CIP as well as PCARRD and college funds. Considerable expertise has been developed in the area of root crop production, storage, processing and utilization for human food and animal feeds, extension, and research information. While PRCRTC is mandated for national research and training on root crops, it has a strong local impact in the development of the root crop industry in the country. PRCRTC is also starting to play a role in root crop research in the whole Asian region. Its research and training therefore, has an impact locally, nationally and internationally.

THE INTEGRATED ROOT CROP PROGRAM

The three distinct components of the program are:

- Integration, evaluation and training
- Production, animal feeding and processing
- Enhanced access to appropriate root crop technologies

Overall Project Design

In its broad design, the project takes into account the integrating purpose of the overall activity and its experimental nature as well as each of the specific research and development programs. Specifically there are two coordinating components, each with its director, program of work and budget allocation.

Program Core Team

Perhaps the more innovative component of the program has been the formulation of the Program Core Team (PCT), a review, coordination and training body. It provides a forum through which issues and mechanisms of integration can be worked out through.

Through it, the broad objectives of developing a sustained pattern of integrated research and extension will be realized and planning will be undertaken for the broader and overall human resource development (HRD) needs of the college.

Its mandate includes the responsibility for:

- i) ensuring continuing dialogue among project personnel as to how and where information exchange and joint activities can be fostered;
- ii) assessing the extent and quality of collaboration and designing methods for enhancing the process;
- iii) generating, synthesizing and documenting valuative data on the integration process;
- iv) planning and executing those activities aimed at facilitating the implementation of all aspects of the research and development programs (i.e., training); and
- v) developing the details of VISCA's overall HRD plans and these relate to IDRC's support.

The PCT will be housed within the Office of the Director of Research and Extension (ODREX) and it will be a part of the regular structure of the College. It will comprise the director of ODREX, chair; the director of PRCRTC, vice-chair; the Program 3 leader as secretary; Programs 1 and 2 leaders and the VISCA president as members. This set up will allow a broad perspective of the progress and needs of the overall research/development project and of the College as a whole.

Research & Development and Extension

The research and development and extension activities will be conducted under the Philippine Root Crop Research and Training Center (PRCRTC), with the PRCRTC Director serving as the program leader for two sub-programs (breeding/production, processing and information/communication and extension). The overall responsibility for the design, implementation and monitoring of the technical components of the research and development work will be under PRCRTC while the day to day implementation of the studies will be handled by the respective team program leaders. The PRCRTC director will ensure that within and among the three programs technical quality is maintained and integration and coordination of the work is realized wherever it is appropriate. He will also take a leading role in coordinating with other research and extension agencies at regional and national levels, especially with the Department of Agriculture (DA) and the Northern Philippine Root Crop Research and Training Center (NPRCRTC).

PROGRAM 1. INTEGRATION, EVALUATION AND TRAINING

The project clearly recognizes that the effective integration of a research and development program of this scope and complexity will be a major undertaking. One for which all the details of the design and implementation can be worked out in advance but which will need continued monitoring, adjustment and reconceptualization. Based on this understanding, the project has incorporated a distinct program coordination mechanism -- the Program Core Team. The PCT has been developed specifically for

this project but is expected to remain in some form as an ongoing feature of ViSCA's integrated activities.

The general objectives and functions of the PCT will be to support and facilitate the cohesion and integration of the research and development programs as a whole and to coordinate those activities aimed at strengthening both the immediate research and the broad institutional staff development needs of ViSCA. These functions will be integration/coordination; planning/evaluation and human resource development.

Integration and Coordination Function

Under its integration function the PCT will organize regular meetings for its members to review program components specifically in terms of the extent and quality of coherence among them; of inhibitors to the effective sharing and use of information between research and extension activities; and of strategies for facilitating more consistent intra-project exchange. It will organize the production of regular working papers on the status of project activities and on the output of those activities; ensure the circulation of these reports; and organize appropriate opportunities for ongoing monitoring and feedback across project activities. Finally, it will organize and conduct twice yearly meetings for project personnel and include the full complement of relevant IDRC staff to review in detail the progress, problems and future directions of the overall project and of its various sub-components.

The first activity to be coordinated by the PCT will be a pre-implementation project planning meeting. The objectives of this workshop, to include all research and development and extension/information program staff will be:

- i) to orient participating personnel and agencies to the overall framework, goals, structure and procedures of the project;
- ii) to draw suggestions for the more detailed planning of these elements;
- iii) to plan explicit evaluation and integration strategies and schedules; and
- iv) to identify potential indicators to assess integration and results.

Similar meetings will be held every six months thereafter to monitor progress and make necessary adjustments. Within six months following project completion, a national seminar will analyze the products and process results of the project. This workshop will be preceded by a post-project evaluation to be organized by IDRC and ViSCA, and conducted by a joint team of ViSCA and an outside resource person.

Evaluation Function

Under its evaluation function, the PCT will ensure the regular monitoring of all project activities. This will include coordinating the production of research and extension evaluation reports by the leaders of the three substantive programs. It will also ensure preparation of reports detailing the effectiveness of coordination among these ac-

tivities. Regular technical progress reports will be submitted for review both to IDRC and to all participating project staff at ViSCA.

To facilitate this formative evaluation work of the PCT, and to ensure an appropriate degree of analytical rigor, comprehensiveness and consistency in data collection, the project will employ a research associate expressly to serve as "process documentalist." In general, he will be responsible for establishing a schedule of data collection, analysis and collaborative reviews of the progress of the project. This will include the regular recording of meeting minutes; interviews with project staff in ViSCA and the participating external agencies, and preparation of status reports for internal circulation and review. A computer will be provided to the PCT to facilitate the regular interactive production of information.

Planning and Human Resource Development

The PCT will be responsible, as its third function, for planning, in coordination with IDRC and the project research/extension personnel, the in-project and degree training activities of the project.

The in-project training will deal specifically with the immediate research and extension training needs of the three programs, i.e., research and design and methods training for project staff, extension workers and farmers (specifically with respect to on-farm and ethnographic methods); materials production and teaching strategies for extension activities; training in extension management (e.g., CDS/ISIS); research management training; biological testing/analyses up-grading. The details of these activities will be developed as the project evolves and specific training needs are identified. It will involve in-house workshops, provision of resource persons as trainers, some in-region study visits and participation in local training programs.

Support for degree training at ViSCA will be within the context of its long-term staff/institutional development; looking beyond the needs of the immediate project in terms of both focus and duration.

PROGRAM 2. PRODUCTION, ANIMAL FEEDING AND PROCESSING

The program on root crop improvement will develop new sweet potato varieties which will meet the needs of small-scale producers especially the subsistence households in the upland areas. In addition, technologies on new or improved cultural management practices for minor root crops, particularly arrowroot (*Maranta arundinacea* Linn.) suited to the conditions of small scale farmers will be generated. The expected major beneficiaries of the technologies generated are the small subsistence rural householders.

The opportunities for improving current feeding practices, reducing the cost of feeding and increasing income from animals by utilizing feeds from sweet potato production will be included in this program.

New food uses for root crops and improved indigenous food products and processes that will meet the technical, economic and social requirements of subsistence processors are the major expected results of the program. It is anticipated that the processing technologies developed will directly benefit subsistence households involved in root crop processing.

PROGRAM 3. ENHANCING ACCESS TO APPROPRIATE ROOT CROP TECHNOLOGIES

Background

The Philippine Root Crops Information Service (PRIS) has accomplished its targeted objectives and outputs as a scientific information analysis center. The PRIS evaluation results revealed PRIS' success in disseminating root crop information to the academic users, teachers and students. However, such information rarely reached extension workers and less literate householders. It was therefore recommended that more involvement of the Department of Agriculture (DA) especially its extension workers be considered; that media other than print be used and that a well-planned, strategic communication campaign be considered. It was the consensus that PRIS should venture into the development and production of a multi-media mix for root crop technologies and that communication and extension staff development should be considered.

Realizing the significance of the services of PRIS, ViSCA has committed to continue its support to maintain its already established bibliographic databases and document delivery services.

This project is designed to effectively disseminate root crop technologies to the farm level of the Philippine uplands.

Objectives

The overall objective of this component of the project is to develop a participatory, integrated extension program that will accelerate the adoption of appropriate root crop technologies by subsistence householders.

Anticipated Beneficiaries

The immediate beneficiaries will be trainers, extension workers and farmers who will be direct audiences of this project. In the long run, it is hoped that all extension workers and farmers involved in root crop production will benefit from the various outputs of this project.

Methodology

This project will be exploratory and evolutionary in nature. Thus, its methodology will be developed and refined through the various seminars and workshops at different stages of the project.

This project will start with a seminar involving representatives from ViSCA, PRCRTC, NPRCRTC (Northern Philippine Root Crop Research and Training Center), the

Department of Agriculture and farmer organizations that will be participating in the project. The objective of this seminar is two-fold:

- i) to present an overall picture of the project so as to cultivate understanding among the project participants;
- ii) to search for general assumptions, principles and strategies which can be used as guidelines of the project.

Project Components

This project consists of the following components:

- preparation and inventory of appropriate root crop technologies
- socio-economic survey
- consumer study
- identification of target groups
- statistical databases
- continuation of information services to scientists and researchers and regional networking
- design and development of extension training program
- development of a communication plan and extension support materials
- piloting
- production and dissemination of extension support materials for pilot regions, and
- feedback mechanisms and process documentation.

Inventory of Appropriate Root Crop Technologies

An inventory of appropriate root crop technologies will be drawn up following an assessment of existing root crop technologies. The assessment process will comprise reviews of completed verification trials and the results of related studies. Farmers, root crop technology developers (e.g., breeders, engineers, food technologists, etc.), communication/extension specialists and socio-economics core team members will participate in this process which should result in a short-list of technologies which are ready for extension. The criteria for readiness, appropriateness and prioritization of technologies for extension will be defined by the team. Root crop technologies which need further verification or on-farm trials will be identified and the necessary trials will be conducted. The results of these trials will be subjected to further agronomic/socio-economic analysis. The socio-economic core group will work together with the extension team on the community-based field trials which will be characterized by active farmer participation. Reconnaissance surveys will help assess which sites have potential for the piloting of the technologies.

Socio-economic Survey

This survey is designed to collect and provide socio-economic and cultural data for all components of this integrated program. Thus, the survey team will begin by conducting a workshop among the program leaders in order to identify each team's needed data. After that, the survey team and survey consultant will design the survey instruments, sampling and data analysis methods as well as determine the survey plan. The survey instruments will be translated into the different dialects of the survey areas and pre-tested with root crop villagers. The survey will be conducted by enumerators selected from the survey areas, who will be trained in survey methodologies. During the course of the survey, the survey team will visit the survey sites in order to supervise the enumerators and ensure the proper conduct of the survey.

Consumer Study

A consumer study will be conducted in parallel with the socio-economic survey. It will be aimed at determining the acceptability of the different varieties of sweet potato and minor root crops by people living in both rural and urban areas. The study will begin with a review of completed consumer studies conducted by market research firms such as Consumer Pulse, Inc. Related literature on food and nutrition will also be reviewed. This will be followed by the design, pre-testing and implementation of the consumer survey. NPRCRTC, as part of this study, will carry out a survey in Northern Luzon to assess the existing post-production system for highland sweet potatoes in the region. The results of the survey will help NPRCRTC to identify topics for its research agenda.

Identification of Target Groups

Results of the socio-economic and consumer surveys will be used to identify target groups and segment them according to their needs and socio-economic environments. Households selected from three pilot areas, (one each in Luzon, Visayas and Southern Mindanao) will participate in a complete extension program.

Statistical Databases

Three regional socio-economic statistical databases to provide up-to-date and reliable information to policy makers, researchers, administrators and other users concerned with root crop developments (particularly the Department of Agriculture and regional research consortia) will be established at the libraries of ViSCA (for Visayas), Benguet State University (for Luzon) and Central Mindanao University (for Mindanao). The teams responsible for handling these operations will be comprised of staff drawn from the Department of Agriculture, Economics and Statistics, and the libraries. The operations will be microcomputer-based, using MINI/MICRO-CDS/ISIS software. (The microcomputers at the Benguet State University and the Central Mindanao University will additionally hold root crop bibliographic databases (on MINI/MICRO-CDS/ISIS) as is already the case for the ViSCA library microcomputer. An initial workshop and subsequent annual meetings will be held to enable the three teams to determine/modify the database structure, to share knowledge about secondary data sources, experiences/feedback on the types of enquiries put to their respective databases as well as the computer-generated outputs that they package for their respective regional clientele. It is expected to pull primary data that will be made available from the projects'

socio-economic survey, but statistical data primarily from secondary sources is envisaged. A training workshop on the MINI/MICRO-CDS/ISIS software for this particular non-bibliographic application will be conducted by an external consultant.

Continuation of Information Services to Scientists and Researchers and Regional Networking

Bibliographic and directory (of researchers) database-building activities, and document delivery services based on the collaboration of the fourteen state colleges and universities that were started under PRIS will be continued. The research development and extension experience of ViSCA and PRCRTC on root crops is of great interest to the Southeast Asian region and during the life of this project, PRCRTC will be communicating with regional scientists and researchers to explore their interest in networking activities, including the sharing of scientific and extension literature. The International Sweet Potato Newsletter which is being published by PRCRTC will continue to be supported.

Design and Development of Extension Training Program

A workshop to design and develop an extension training program will be conducted. The team will construct training curricula and training media which will consist of print as well as audio-visual aids. The training is designed to stimulate community participation in accelerating the adoption of root crop technologies as well as encourage extension workers and farmers to use participatory problem-solving methods.

The training program will start with the training of trainers. This training will aim at strengthening the training capacity of three teams of regional personnel from the Department of Agriculture. Each team will consist of a Regional Coordinator on Root Crops, a Regional Information Officer and a Regional Training Coordinator. The regional teams will in turn train the provincial and municipal workers in the identified regional areas. Finally, these extension workers will train the farmers.

Development of Communication Plan, Strategies and Extension Support Materials

A communication plan which will describe the media-mix, and the content and format of messages will be developed based on the results of the socio-economic survey and target groups identified. It will guide the development, production, dissemination and evaluation of extension support materials. It is envisaged that the full range of broadcast, print and indigenous media will be employed. The exact mix will depend on an analysis of information collected through the socio-economic survey. This will include the degree of access to different media forms, the degree of functional literacy, the credibility rating of various indigenous communication channels and the range of the different media and channels. The formulation of messages and design of extension support materials will be carried out by communication specialists working closely with the appropriate researchers and extension specialists. All messages and prototype materials will be field-tested, refined and if necessary, tested again on members of the various target groups prior to their final mass production and application within the extension program.

Piloting

After the training program and the extension support materials have been designed, tested and reproduced, the training for trainers, extension workers and farmers of three villages (one each in Luzon, the Visayas and Mindanao) will be arranged. These pilot areas will serve as a learning and social laboratory for testing, verification, and adoption of extension services and root crop technologies. The project will be implemented in three regions of the country and one municipality in each region. The regions that have been considered are the root crop growing regions of the country. These are Region V (Bicol), Region VIII (Eastern Visayas) and Region IX (Southwestern Mindanao).

Production and Dissemination of Extension Support Materials for Pilot Regions

The Information Team at ViSCA which had been previously responsible for the publication lines of the Philippine Root Crops Information Service (PRIS) will be handling the mass production of the extension support materials for the pilot regions when the final version of the prototype materials are ready. Dissemination of the extension support materials to the pilot areas will be coordinated with field visits and the distribution of inputs and supplies (planting materials, fertilizers, etc.) and hence there will be close liaison with the Department of Agriculture and the Agricultural Training Institute with regard to the required number of copies for each pilot region and the time frame for the distribution process. The other major root crop producing regions of the Philippines, Benguet/ Mountain Province and Northern/Central Mindanao will not receive the full extension service treatment planned for the selected pilot sites. However, once the extension support materials have been prototyped, they will be made available in the non-pilot regions to the Regional Applied Communications Units (RACUs) which are the regular channels of the Department of Agriculture for producing and disseminating information to extension agents and farmers. Each RACU will be given "topping up" funds (in addition to its regular institutional budgets) to adopt the prototype materials itself to meet local requirements for subsequent mass production and dissemination for the region of its responsibility. An early workshop is to be held to brief representatives from each RACU to ensure that there is an understanding of their own particular roles within the totality of his extension program as well as of the whole project. Annual training workshops will be conducted on adapting the prototype materials for the RACUs.

The objective of dissemination in the non-pilot regions is to ensure there is information available to subsistence households in the other important root-crop producing regions which have not been selected as the pilot regions.

The RACUs are expected to keep careful records of their activities for input into the process documentation of the program.

Feedback Mechanisms and Process Documentation

This extension program will be designed to enhance close interaction among farmers, extension specialists and researchers/scientists. The feedback mechanisms will be developed to facilitate the flow of information among them. All activities and processes

entailed in this project will be documented. Information and data derived from the feedback mechanisms and documentation will be analyzed periodically for validating and refining the extension program.

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Farm Management Data for Thai Farmers

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The optimization of income at the farm household level in Thailand during the 6th National Economic and Social Development Plan (1987-1991) is aimed at improving the income of farmers both in rainfed and irrigated areas. The strategy lies in the reduction of risk in crop production through the full and efficient use of farm resources. The growing of diversified crops to spread the risk of total crop failure due to force majeure and to reduce income loss in times of lower prices for some products has been promoted. Integrated farming systems which incorporate fish and animal enterprises with crops are recommended to provide an even distribution of income for farmers throughout the year. The planting of short-duration crops before or after the main economic crop is also recommended. The government, through the different agencies concerned, will provide and implement the following:

- Support research, development and technical services to give farmers more choices in the selection of farming activities.
- Increase emphasis on agro-forestry in the farming system.
- Support and promote crop diversification, particularly those products which are in demand and are import substitution crops.
- Provide production input and credit as required by the clientele farmers.
- Promote actions by groups of farmers in cooperatively investing in particular kinds of crops which are in demand.
- Stress the need for growing crops suited to particular economic and agro-ecological zones for better management.

Thailand has implemented several projects aimed at providing data to the farmers. Among the agencies involved are Agricultural Extension, Livestock Development, and the Universities of Chiang Mai, Khon Kaen and Kasetsart. Another project is the Thai Agricultural Colleges Transfer of Information Cooperative Service (TACTICS).

TACTICS provides an information service for the 44 vocational agricultural colleges throughout the country under the Department of Vocational Education (DOVE). Seven of the colleges were nominated as regional coordinating centers: Kamphaeng Phet, Buriram, Chaiyaphum, Pathum Thani, Singburi, Chumphon and Songkhla Fishery College. The project is based at Lamphun Agricultural College (LAC) in the Northern Region. The main goal of TACTICS is to facilitate the flow and appropriate

use of information among extension workers, teachers and students at the agricultural colleges, local farmers and local sources of information. The activities include:

- Collection of farm management data.
- Analysis, appropriate presentation, and distribution of this data to farmers, extension workers, teachers and students.
- Linking the agricultural colleges through Lamphun Agricultural College with local sources of agricultural information to support extension services and teaching/learning activities.
- Developing the library, including a reference collection, a current awareness service, document delivery and inter-library loans.

Data for the farm management project is collected and then distributed in an appropriate form at the local level. First, select key farm products and design a methodology for data collection. Second, produce a general reference manual (GERM) and develop appropriate derivative products -- the farmers' reference manuals (FARM) and the teaching reference manuals (TERM). Third, distribute these to agricultural colleges, extension workers and farmers in the region.

FARM: This would be designed for use by the farmers in conjunction with extension workers in making such decisions as the comparative profits involved in different products and the potential risks.

TERM: This would be designed for use by the teachers in conjunction with students for such purposes as improving curricula, providing reference materials for teaching and for students' special projects.

This is another way of expanding the role of agricultural colleges beyond formal instruction by providing information in the form of farmers' manuals in order to promote new technologies and research results among farmers and to encourage them to improve their lives by keeping aware of current farm management data.

On Effective Ways for Information Research to Serve the Rural Economy

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Abstract

The paper analyzes the present status and the existing problem of agricultural information research in China. The author, according to the new demands of the development of a rural commodity economy on information work at the present stage, studied the effective ways for information research to promote the development of the rural commodity economy, including: To take serving the rural economy as its main task; To reform the jurisdictional relationship of information research institutes; To strengthen the liaison and coordination both inside and outside of the information research system; To pay attention to users' demands; To speed the process of normalization and standardization for information research achievements; To develop commercialization products; To speed up the modernization of operation and to raise the quality of the research personnel.

Social demands are a fundamental power in promoting the development of information research work in depth and over a wide range. China's rural economy is gradually changing into a commodity economy from a natural economy as the economic system reform deepens. A new productive style and economic motive mechanism have been preliminarily formed. This new circumstance has brought along some new requirements for scientific and technical information work, especially information analysis and synthesis. How information research work suits the needs of the rapid development of China's agricultural sciences and techniques and farming economy is a common concern for information research personnel. For this reason, it is necessary that the present status and existing problems of China's agricultural information research work are analyzed, and effective ways and strategies for serving the rural commodity economy's information analysis and synthesis requirements are studied.

I. The present status and existing problems of agricultural information research work in China

It is reported that about 30-40 percent of the growth in the total output value from farming were achieved by agrotechnical advances during 1981-1985 in China. Technical improvements depend on information as a medium or bridge. Information analysis and synthesis is an important part of agricultural scientific and technical information work in China. In order to suit the changed conditions, information research has become

both technical and specialized in recent years. The goal, content and method of information research have greatly changed.

1. To change from unitary agricultural scientific and technical information work to comprehensive information research.

In the past, China's agricultural information research was confined to the range of agricultural science and technology, and only made a few investigations on the differences between home and abroad. Along with the reform of the rural economic structure, information research now conscientiously and enthusiastically combines with the modernization of agriculture and science and technology. Some large-scale, comprehensive and strategic research tasks, which were assigned by leading or policy-making bodies at a higher level, have been undertaken for example, to make macro-strategic decisions, to transform agricultural techniques, to readjust the industrial structure, to exploit and use natural resources, to reform the agricultural research system, and to draw up a long-term program for farming development.

2. To change from a simple qualitative analysis to a combination of qualitative with quantitative analysis.

In the past few years, the social demands for information have greatly increased, due to the appearance of markets and contracts for scientific and technical information. The goal of agricultural information research has gone far beyond the traditional range of affording precise and orderly information for policy makers, and is developing from a microscopic view of agricultural science and technology to a macroscopic one of economy and society. New claims are being made for information research work, including its being scientific, comprehensive, systematic, accurate, feasible, timely, practical, of economic benefits, and so on. Owing to the above changes, information research has hardly satisfied the different needs of the society by only using methods of formal logic and qualitative analysis. Mathematical statistics, applied mathematics and systems engineering have been used as analytical means for agricultural information research. Using a combination of qualitative with quantitative analysis has become an effective approach in information analysis and synthesis in China.

3. To change from independent research to cooperative research.

China is a great agricultural nation. However, agricultural information personnel make up less than one percent of the agricultural scientists and technicians in China. The combination and cooperation of multi-disciplines is one of the most important characteristics of modern agricultural science and technology. This characteristic also decides the necessity of cooperative research for information analysis and synthesis to make up for the shortage of personnel and to provide research reports of high quality within a shorter time. In the past few years, the personnel from research institutes, universities and administrative departments, joined in some large-scale information research projects. The research reports they produced have achieved long-lasting social results.

4. To change from a gratuitous information service to a combination of gratuitous with paid-for service.

Economic means have been used to manage the information activities for changing a gratuitous information service to a partially paid-for service. The initiative of research personnel is brought into play and the vitality of information departments is raised by economic levers. In recent years, most projects of agricultural information research have been listed in annual scientific research plans. The related organizations must provide relevant research funds while assigning the research projects. In substance, this style is also an embryonic form for carrying out an information research contract and paid-for transfer of information research achievements.

However, the following unadapted phenomena for information of a scientific and technical system and rural economic structure are revealed:

1. The current basic structure and managerial system of information work unadapted extremely the information research to the development. China's information systems were basically built on the basis of an administrative system that is weak in serving agricultural production. The social function of information research has failed to be brought into full play.
2. Unified policies and rules in information research work are lacking. Although it is a leading organization of our national agricultural information system, the Center of Scientific and Technical Documentation and Information of the Chinese Academy of Agricultural Sciences is neither authoritative nor its guidelines binding. It is difficult to organize and coordinate the agricultural information system of the whole nation.
3. Information research cannot effectively serve agricultural production and the rural commodity economy because it is limited by the concept of "scientific and technical information."
4. The information research personnel are lacking in both quantity and quality. According to a findings report for 64 agricultural information units in China, there are an average of 3.3 information research personnel in each unit. Most of them were previously engaged in agricultural research, and have been working in information research work for less than five years. The organizational structure is one of the important factors impairing the quality of information research.

II. Effective ways and strategies for information analysis and synthesis work to serve the rural economy

Along with the reform of the rural economic system, the traditional natural economy has been seriously pounded and is gradually being replaced by a commodity economy in the vast countryside. It is forecast that China's countryside will soon become another highly concentrated area of information specialists in addition to scientific research and industry.

In order to meet the extensive needs of a rural commodity economy for information research and to promote the development of information research of superior quality and high applied value, the author suggests that it is necessary to adopt the following effective methods and strategies.

1. Information research work must take serving the rural commodity economy as its main task.

In 1988, the Fifth National Working Conference of Agricultural Scientific and Technical Information and Documentation stated that agricultural information research work should not only follow the advancing tracks of agricultural science and technology at home and abroad but also launch macro information research for serving policy-making during the next several years. It is imperative to carry out technological information research in the light of specific technical problems and to provide a scientific basis for evaluating achievements and developing the rural commodity economy.

Nowadays, the rural commodity economy is particularly brisk, and competition is very sharp, too. Obviously, agricultural information research which serves the rural commodity economy can't also suit the speedily developing situation unless its mode is changed and its domain is expanded. Agricultural information research work should take serving the rural economy as its main task. This should include providing comprehensive and predictive research reports for leading organizations at all levels, to furnishing reliable information to make decision-making democratic and scientific, and serving the technical transformation of agriculture and the development of export-oriented agriculture.

2. The jurisdictional relationship of information research organizations must be reformed.

Although the system of China's agricultural scientific and technical information has preliminarily changed, the fact that agricultural information organizations depend on their higher administrative departments or institutes has not been transformed. The present situation is unfavorable to the development of information research. Therefore, the information research system must transform from a dependent research unit relying on administrative departments to an independent one. A national bureau of agricultural information and a unified management system from central to local authorities should be set up. They should play both administrative and vocational leadership roles.

3. Strengthen the liaisons and coordination both inside and outside the information research system.

In recent years, various advisory organizations related to agriculture have been established. This situation impels the agricultural information units to strengthen their horizontal connections and to prove their superiority in competitive conditions. The professional information contingent must combine with the amateur, and the information research work must be in close agreement with national demands to enlist the support of leading departments. This working method can improve the quality of research reports and the prestige of information research organizations.

4. We must pay attention to the users' demands to improve the optimum seeking ratio of research projects.

Information users are the core of the whole process of information research and the key to raising the optimum seeking ratio for projects. The users of agricultural information research mainly include the personnel of policy-making offices, management departments, research institutes, technical extension stations and educational bodies for agriculture at different levels and township enterprises in China. They need not only information of their own professions but also of the developments in management, commodity circulation and related sciences.

5. To speed the process of normalization and standardization for research achievements, management formalities must be enforced as strictly for information research projects as for scientific research projects.

The standard for judging research achievements should be laid down scientifically. This would serve to affirm and extend the achievement, to kindle the researchers' enthusiasm and creativity, and to raise the level and quality of the research.

6. The commercialization and paid-for service in information products should be implemented.

An information product is a commodity property. It is an intellectual commodity. Commercialization of information products is the only way that information work can serve society. The reports on information analysis and synthesis also would be brought into the category of information commercialization.

An information product ought to carry out the paid-for transfer and exchange according to the law of value of commodity production. It is necessary that we make a thorough study about the cost and price of information products.

While advocating the commercialization of information products and putting into practice paid-for service, we can't ignore the fact that an information organization is a public welfare body. The relationship of paid-for service to gratuitous service must be handled correctly.

7. Speed up the modernization of operations for information research.

From a long-term point of view, it is necessary to found automated office systems. Information research organizations must pay attention to the accumulation of data to form one's small-scale fact base and vocational records. Computers and sufficient modern equipment should be provided.

All problems involved with information research could probably be solved by expert systems. Once demand combines with possibility, the information expert system, based on artificial intelligence, will be developed.

8. Raise the quality of the information personnel and train the 'T' model talent who combine information research with economic construction.

The level of information research achievements depends on the quality and ability of the personnel who are working on it. However, most of them graduated from agricultural universities and are short in knowledge of informatics, systems science, management science, computer science and economics. It is necessary to establish training centers for agricultural information research at both national and local levels so that a contingent of information researchers is built to meet the needs of modern information work and to serve the rural economy.

The emphasis must be placed on the intellectual structure of the integral "T" model both in the depth and range of professional knowledge inside the information organization, because the ideal talent of 'T' model is in short supply at present.

Preliminary Study on Ways of Transforming Agricultural Science Information into Productive Forces

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Abstract

In order to effectively transform information on the science and technology of agriculture into productive forces, we must develop five lines of service: namely services rendered for policy makers, for agricultural research, for agricultural production, and for importing technology, as well as establishing a mechanism to deal with scientific and technological information. The relation between scientific and technological information and productive forces is addressed separately in this article by citing five different examples of the application of information and suggesting that agricultural information activities should be strengthened in seven aspects.

The progress of scientific and technological information is a direct motive force for social development. The progress of modern information in science and technology promotes the coordinated development of technology, economy and society and the rapid renewal of man's knowledge and the technical products of man's knowledge. In developed countries, information activity has run the course of each social activity. Tremendous productive forces have been generated continuously by the close integration of resources of information, material and talent. The scientific and technological information service is one of the most important means to transform it into productive forces and a bridge for passing science and technology to society. In order to effectively transform scientific and technological information on agriculture into productive forces, five approaches must be developed.

I. Provide service to leaders for making policy decisions

There are close relations between the leaders' policy decisions and our country's economic well-being. If the policy decisions made by the leaders tallies with the actual local situation and that of our country and conforms to the requirements for the development of productive forces, they will promote the development of productive forces, otherwise, they will hinder the development.

Scientific policy decisions stem from accurate forecasts based on the analysis of a vast amount of valuable scientific information. Policy decisions will hardly be workable or successful if they are in conflict with available information. Therefore, methods to grasp

information determine policy decisions and directly influence the development of productive forces.

In recent years, the international economic industrial structure has been undergoing major adjustments and in view of the characteristics and current situation of the development of productive forces in the elementary stage of socialism in our country, the Central Committee of the party has put forward the strategic decision to develop externally-oriented agriculture in the open economic zones and the coastal port cities. It brings the economic superiority in coastal areas into full play and greatly promotes the growth of productive forces. The Macroscopic Agricultural Research Laboratory in the Fujian Academy of Agricultural Sciences provides timely reference materials such as investigative reports on the externally oriented agricultural base for the production of export commodities, thus providing a scientific basis for leaders to make policy decisions. According to information on the international market supply and demand and in accordance with an accurate market forecast and technological information on various aspects such as production, processing, storage, transportation, etc., Fujian Province has drafted a medium term and a long term development program, rationally arranged the distribution and scale of its production bases and confirmed the key products to be produced, thus ensuring the development of the externally-oriented type of agriculture. In 1988 the foreign-exchange-earning agriculture in the whole province achieved remarkable success. Its exports reached 458 million US dollars, i.e., an annual increase of 20.7% over that in 1987.

After obtaining economic and technological information on the demand of asparagus in the international market, Dongshang County, Fujian Province, took advantage of its local natural conditions to develop asparagus for export in a big way. In 1987 it put 1.2 thousand hectares into the production of asparagus and earned over 13 million US dollars. In 1989 it put 5 thousand hectares into asparagus production and an earning of 35 million US dollars is being estimated. This shows that correct policy decisions can promote the development of productive forces enormously.

On the other hand, if great attention is not paid to research information, it is possible to make incorrect policy decisions and sustain failures. "The Long Hair Rabbit Event," "The Cauliflower Event," "The Mushroom Event" and other unsuccessful endeavors should be kept in mind as profound lessons.

II. Provide service to science research

Science and technology are productive forces. In many countries, science and technology are held in high esteem. The development of science and technology is regarded as a key means to realize the strategic goal of a country's development. A current trend which is worth paying attention to is the intensified competition in the development of science and technology in the world. Information on science and technology is the basis of scientific research. It is a scaling ladder and a powerful instrument for scientific and technological development. We are aware that it is only through the extensive collection of information for making research and analysis, and its timely implementation in

order to make our science and technology plans and to develop the best research and production program that we shall be able to be successful in the international high technology market.

In order to speed up the development of science and technology, we must pay attention to collecting and sorting out information, advancing new questions and drawing new conclusions on the basis of achievements already gained by others. Nowhere is there any exception in the research work of agricultural science. Every phase of research work starting from the selection of the subject to its description, its implementation and its appraisal as well as its spread and application cannot be carried on without information at every stage.

In recent years, information on science and technology in agriculture has played an enormous role in agricultural research. For example, before setting up a new research subject and after obtaining "The Catalogue on the Subject of Hybrid Rice" supplied by the information office of the academy, the Department of research on Hybrid Rice in the Hunan Academy of Agricultural Science proceeded to collect a large amount of domestic and foreign research data on hybrid rice, thus promoting the process of research work greatly, and increasing the research benefits and making their theory on the basic research and production technology of hybrid rice lead the world. This achievement has spread widely throughout the whole country and achieved enormous social and economic benefits, and also energetically promoted the development of agricultural productive forces in our country. Many examples in each province of our country have proven that the work of science and technology information has made remarkable contributions in accomplishing more in scientific research, making achievements quickly, and transforming achievements into productive forces more quickly as well.

III. Provide service to agricultural production

Scientific and technological information work is the bridge and medium of connecting science and technology-production-trade in one chain. It has the stronger ability of coordination and organization by itself. It participates in the whole process of social material production while promoting the coordinated development between the economy and science and technology and between production and science and technology. It energetically raises the standard of management efficiency, labor productivity and economic benefits.

With the deepening of economic system reform and the implementation of the policy of opening up to the world and the stimulation of the economy, the economy of rural areas in our country is changing from a natural economy and a production economy to the track of a step-by-step planned commodity economy. Commodity production will lead to trade competition. Not only must we keep informed of all aspects of agricultural technology information but we must also pay attention to the development of the commodity information market and science and technology information on diversified

trade and comprehensive trade so as to promote the development of a commodity economy.

In accordance with domestic and foreign market demand, the Research Institute of Terrestrial Heat in the Fujian Academy of Agricultural Sciences brings the terrestrial heat superiority and technology strength now available in its own institute into full play, breeding tropical ornamental fish and growing species of indoor ornamental flowers. According to conditions of geography, climate and quality of seed resources in our province, the information office of this institute issues a series of valuable information such as "Domestic and Foreign Market Development of Tropical Ornamental Fish," "Species of Ornamental Fish Available for Breeding," "The Up-to-date Species of Indoor Ornamental Flowers in the World Market" as a reference for relevant researchers and corrected the trend of blindly importing low-grade tropical fish. At present, ornamental fish and the nursed seeds of ornamental flowers have been exported to Hong Kong. Ten thousand nursed ornamental flowering plants have been sold to eleven provinces and cities all over the country in one year. Enormous social and economic benefits have been achieved.

For another example, the information network set up jointly by Sannong (Namely: "Agricultural Science and Technology Information on Externally Oriented Agriculture," "Information on Agricultural Science and Technology," and "Information on Agriculture") provides information regularly to its grass-roots agricultural units. The level of agricultural technology in some grass-root units has raised greatly and promotes the development of agricultural production through the use of improved seeds and adopting new technology. Some grass-root units have improved their ability to earn foreign currency by exporting subsidiary agricultural products. For instance, after obtaining the information on "New Technology on High-yielding Corn," "The Application of Aspirin in Agricultural Production," and "Stembright Control of Asparagus," the Agricultural Committee in Fuchin County published the above relevant information in the county-run *Agricultural Science and Technology* and printed more than ten thousand copies for distribution, thus promoting the development of corn and asparagus production greatly. In 1988, the planting area of corn was enlarged in the whole county. The total output had increased by 78.3%. The output per mu was 163 kg, i.e., an increase of 51.3% over that in 1987. When they discovered the information contained in "Shortage of Peanut Supply and an Advance in Price in the World Market," Yinxi County quickly contacted foreign merchants and produced salted crisp peanuts for export and exported twenty tons of peanuts in February 1989.

IV. Provide service for the importation of technology

In the world of today, every country is active in importing advanced technology to promote the economic development of its own country. It is important to develop productive forces on a new and higher plane through the introduction of new technology. The introduction of technology and improved seeds is a more difficult task. It usually involves the development and utilization of the market, power and resources. It needs relevant funding, talent, and technology, too. Therefore, before determining

which item to import, we must collect a large amount of accurate domestic and foreign information, investigate extensively and study carefully to explore its feasibility so as to ensure that the imported item is highly reliable and applicable. The success of importing advanced technology depends on making the correct importing plan drawn out of accurate information.

Meanwhile the Information Research Office of the Information Department of Fujian Academy of Agricultural Sciences is now collecting Taiwan's agricultural data. At the same time it pays attention to grasp both the recent information on agriculturally improved species of seeds and new technology for the timely reference of the agricultural units concerned. The Improved Seed Development Company of the Academy has successively imported more than 150 improved species of seeds such as sugarcane, rice, sweet potato, watermelon, asparagus, Chinese cabbage, green cauliflower and so on according to information on improved species of seeds and the information on marketing and trade for 21 counties and 32 units in Fujian. Among these improved seeds, "Xin Hong Bao" watermelon seedlings have been planted for trial and have been well received in nearly ten provinces and municipalities in our country. In 1987 the total amount of its planting area was 420 thousand hectares in the whole country, and production increased by 13-60%. It is estimated that its increased benefit amounts to more than 7,200 thousand yuan. On the basis of the above, the company cooperated with foreign merchants, imported and improved parental-maternal combinations for production and then re-exported them abroad to earn foreign currency in return.

For another example, before its establishment and during the course of production, the Fujian Mawei Aquatic Product and Feed Company, Ltd. collected information on the production, sale and marketing of prawn and prawn feed as well as information on numerous pieces of feed production equipment in the world through all channels including the Information Department of the Fujian Academy of Agricultural Sciences and decided to import semi-automatic feed production equipment at the 1970s technological level, and the most scientific production prescription of the 1980s. This is the result of taking into consideration both the level of feed production in our country and the research and analysis work done by the company. The preparatory work done by the company resulted in its achieving great success in digesting the imported technology and the national implementation of producing feed additives. Not only has it enlarged the supply of raw materials but has also reduced production costs and made the production price more competitive. Now its production has been thrown into the international market and the annual output has reached 20-odd thousand tons. The output value has reached over 100 million yuan. The annual profit is over 20 million yuan. However in the corresponding period, a certain aquatic production and feed company in Fujian province invested more but developed slowly due to blindly importing without paying attention to information research. Its annual output did not reach one tenth of that of Mawei Company. Consequently, the progressiveness of science and technology information is the basic requirement of importing technology. It is only by depending on its progressiveness that we can get twice the result of import benefits with half the effort.

V. Setting up an Information--production--management entity

With the continuing deepening of the reform of economy, science, and technology systems, the place of information in science and technology will change fundamentally. One of the effective means of transforming information on science and technology into productive forces rapidly is to bring the work of information on science and technology into the fields of economic activities, to form a new information--production--management entity, to take the road of information--production--trade unity.

After obtaining accurate and applicable information on the basis of assessing, analyzing, and screening a great amount of information, the researchers of science and technology information must test it through the production--management entity and put science and technology directly into production. After having achieved obvious economic benefits and experiences of production, they should make it widely popularized and produce the various kinds of commodities demanded in the marketplace.

The Quan Zhou Science and Technology Demonstration Breeding Team set up cooperatively by the Quan Zhou Institute of Information on Science and Technology and breeding-specialized households is an attempt to promote the integration of technology information with the agricultural commodity economy's research, development, production and trade. Now it has offered information in kind to specialized breeding households--over 2,000 genuine young Beijing ducks and over 12,000 young hybrid Beijing ducks, and has incessantly undertaken to supply and pass on its technology information. At present, it has provided 13,000-odd Beijing ducks weighing 25,000-odd kgs to the market and enabled the transformation of information on science and technology into productive forces as quickly as possible.

Thus it can be seen that information on science and technology is a potential productive force. In an information society, the development of productive forces has close links with the grasp and application of information. Our service for this information is to activate knowledge into information first and then to transform information into productive forces. In order to transform information on science and technology into productive forces, we must put more strength in our work as follows:

1. Strengthen the attitude toward information. The attitude toward information must be strengthened on the part of the leaders, cadres, researchers and library information researchers. Information researchers should join the policy-making group and take part in discussing potential research subjects.
2. Strengthen the structure of information on agricultural science and technology and amplify the information network. We must extensively collect important documents about science and technology from different countries in the world, coordinate publications with information, unify planning and arrangements, promote the units which are responsible for doing information research, making reports, translating and rendering services.

3. Improve the basic quality of agriculture information researchers. First, information personnel must cultivate a firm view toward service and adopt a good attitude toward rendering services, gear up to society and go deep into the front line of scientific research and economic construction. Second, information specialists must have proficient service skills, must be particular about serving information researchers, must be proficient in their professional work, improve their ability to analyze, judge and summarize information continuously and be good at watching out for new developments and improve their ability to make predictions.

4. Make full use of oral and information in kind. In the course of their work on the international economy, foreign merchants and traders from Hong Kong and Taiwan and overseas Chinese traders are in possession of a great amount of information. We should pay full attention to that information and bring it into full play by talking with them or by using letters and telephones to obtain various categories of advanced applicable information.

5. Improve the means of information services. It is a task of great urgency to realize the modernization of information in science and technology. Every province and every district should lose no time in setting up the a Computer Search Service System so as to form a national network as early as possible. It is suggested that the Computer Information Policy-making Supporting System should be set up at the same time, which consists of a data bank, model pool, method base, knowledge base and management system so as to make the computer not only provide information in time, but also analyze and forecast.

6. Develop various advisory services to meet the needs of society. We should make full use of social strengths to organize a science and technology advisory service company and develop multi-level and multi-functional information services such as various information research services, marketing and technical training services, etc., in order to transform information into productive forces as early as possible.

7. Pay attention to the role of feedback. The feedback of information is the consequence about the application of information by consumers which reflects first the social and economic benefit produced by the work of information on science and technology and second, the requirements and opinions of agricultural consumers at various levels. This makes us continuously improve our methodology in rendering information services, acquiring more benefits, and promoting the transformation of information into productive forces.

Studies on Agricultural Information Research for the Development of a Rural Commodity Economy

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Abstract

After reforming the rural economic system in our country, the commodity economy has made great advances, and great changes have taken place in the structure, content and forms of information being used. Agricultural information research has shown the following tendencies: a) it turns in the direction of economic construction; b) it is developing in depth and width; c) it diversifies in content and form in many ways and d) it is developing in the direction of cooperation and modernization. In order to fit the new situation, new ideas such as improved information, combined cooperation, self-development, information commodities, and training qualified personnel are established in information research, the focal points of which are information and technology policy, level of production, dynamic prediction, comprehensive evaluation and so forth. In order to do our best to serve the rural commodity economy, scientists of information service have made advances by taking part in the exploitation of agricultural production, by spreading advanced scientific research achievements, by opening up agricultural products for export, by studying and exploring new products, by making propaganda of scientific information, and by imparting technical skills in the field of agricultural production. In addition, they have made recommendations such as how to strengthen the information system, how to train qualified personnel, how to serve the rural economy, how to treat information as a commodity and how to raise the quality of information research and the level of achievements and so on.

With the rise of a new technical revolution throughout the whole world, the implementation of the reform policy, opening up to foreign countries, stimulating the development of the national economy, regulating the rural industrial structure, vigorously developing science and technology and enterprises in villages and towns, great changes have taken place in agricultural production. The transformation of traditional agriculture to a modernized one, a natural economy to a commodity economy, decentralized and independent management to one of moderate-scale and a single type of cereal production to a comprehensive system of trade, industry and agriculture has enhanced the development of a rural commodity economy. This new situation has opened up a broad avenue, has created a higher demand for agricultural information and is faced with a new challenge.

I. The characteristics of changes in the requirements of agricultural information users and the tendency of the development of information research.

A. The characteristics of changes in the requirements for agricultural information

1. The structure of agricultural information users is developing in many ways and is serving people of all occupations and people living in cities, towns and villages. Based on service for the leaders and scientists in one's own institution, agricultural information service is being extended to agricultural administrative managers, to scientists who are extending new agricultural techniques, to people who are working in enterprises in villages and towns and to farmers who are demonstrating agricultural sciences and technology.

2. The requirement of the content of agricultural information is enlarged extensively. It has developed from the microscopic problems of agricultural sciences and technology to those of macroscopic sciences and technology, the economy, and social management such as the economy of agricultural techniques, the production of commodities, marketing, scientific management, technical policies, development strategies, crop production, animal husbandry, the processing of agricultural products and products of sideline production and a diversified economy, all of which merge technical development and market exploitation into an organic whole.

3. The forms of agricultural information requirements such as intermediary services, market prediction, feasibility argumentation, achievement certification, combined exploitation, consultation in kind, propaganda, training qualified personnel, organization of contracts and so forth are highly varied.

4. The quality requirement of agricultural information products is becoming higher. Higher value is put on its scientific basis, its comprehensiveness, its being systematic, its accuracy, feasibility, timeliness, and practicality and the economic benefit of information research products.

B. The tendency of the development of information research

1. Agricultural information research is developing in depth and width, and is closely associated with economic construction. The exploitation, processing and application of information resources have broken through the limitations of documentation, and have gone into society, the economy and agricultural production. The tendency to move from individual research to comprehensive, from practical research to predictive, from static research to dynamic and from closed research to open has occurred. Therefore, a lot of dynamic information, practical typical surveys, comprehensive investigations, scientific data which leaders at different levels use to make strategic decisions was developed. At the same time, it is also regulated in the field for aim, accuracy and implementation respectively.

2. Strategic information research is developing in depth and width, and tactical information research is deepening in its content. At the time of investigation, traditional summaries and reviews of information are replaced by comprehensive, predictive and planning information research of strategic decisions in order to provide a scientific and even basis for the decisions of leaders. At the same time, technical, economic and marketing tactical information research has been deeply developed.

3. Broadening the channels of information services and raising the effectiveness of social services.

Information is necessary to have distinctive resources, commodities, circulation and advanced characteristics, because agricultural scientific and technological information is a potential product and would become real productivity through conditions of transformation. For this reason, information research on industrial exploitation, market trade, economic techniques, economic management and international cooperation has been vigorously developed for agricultural extension services, high-yield plans, spark plans, enterprises in villages and towns, helping poor farmers to become rich, and acting as bridges for units of scientific research, production and economy. They are also developed for the exploitation, intermediary transfer and comprehensive units of information production.

4. Information research is developing in the field of cooperative transformation, modernization of investigative measures and information products as commodities. It is necessary to cooperate and combine with many scientific research branches and units, because information research should be extensive and comprehensive. Mathematical models, the theory of systematic engineering, computers and resource analytical tools are used as major measures of information research. In order to raise the effect of information service and strengthen self-vitality, information research is developed for paid and lower-paid services.

II. Strategic changes of information research have taken place in order to fit the development of new situations.

A. Setting up a new idea

In order to satisfy the demand for reform of the rural economic system, and the scientific and technological system, the old model and mechanism of agricultural information must be reformed. It is important to renew the ideological idea of information research. First of all, it is necessary to set up the concept of great information, and to use great science and technology for great agriculture. It is developing and penetrating to the field of economy, production and society. For example, we carried out information research on the studies of markets and technical cooperation of agricultural products in the Soviet Union and countries in Eastern Europe, the countermeasure of developing research joining rural specialties and comprehensive units of science, technology and production. Second, it is necessary to foster the idea of comprehensive cooperation. In order to get more achievements, to obtain achievements quickly and improve their quality, we advocate the combination of multiple specialties and scientific branches,

inside and outside, in a matrix to join superior, qualified scientists and technicians. For instance, the State Scientific and Technological Commission has assigned a key project on the reform of scientific and technological systems in Heilongjiang Province, and then the Provincial Scientific and Technological Commission has divided it into thirteen subprojects and has organized more than fifty scientists who came from more than twenty units of natural sciences, social sciences and agricultural management to finish them in one and a half years. Third, it is necessary to establish an idea of self-development. We have gotten programs and funds from the Provincial Agricultural Bureau, the Provincial Scientific and Technological Commission, and the Chinese Academy of Agricultural Sciences, Ministry of Agriculture, we have made recommendations and consultations to provincial governors and leaders on our own initiative in order to enlarge our tremendous influence on agricultural production. Fourth, it is necessary to foster the idea of an information commodity. We have opened an offset printing factory and a duplicating room, conducted translation and training, and investigated the effect of plant growth regulators in order to get more income and raise the capacity of self-development. Fifth, it is necessary to foster the idea of qualified scientists and technicians. Man is a carrier of knowledge. The quality of qualified personnel determines the level of achievements. We have sent middle rank scientists to TV universities, and sparetime universities. Last year we sent two scientists to the Soviet Union on a study tour and cooperative investigation.

B. New content of information research

1. Conducting the investigation of agricultural scientific and technological policy.

According to the demands of agricultural technical policy worked out by the provincial government, an agricultural technical policy and the policy of soybean exportation were investigated by us and the Office of Science and Technology of the Provincial Agricultural Bureau. These recommendations in policies provide a basis for working out agricultural plans and their accomplishment. In addition, they play the role of a staff officer for leaders to resolve the problems of soybean exportation.

2. Conducting the investigation of dynamics and levels of agricultural production, the tendency of its development and countermeasures.

In 1986 the Institute of Information of the Chinese Academy of Agricultural Sciences, organized scientific research institutes and teaching departments to conduct a program called "Experience of cultural practices of soybean production in foreign countries and recommendations about how to develop soybean production in our country," which played a significant role in working out a plan for soybean production in the whole country and in guiding soybean production. The project has won a third class prize given by the Ministry of Agriculture. In the light of the practice of soybean production in our province, several papers such as "Recommendations for developing soybean production and its prospects" and "The comprehensive exploitation, processing and utilization of soybean" were written and played a role in working out the plan of agricultural production, and in providing a basis for offering a program of soybean processing. They

were selected as textbooks for training courses by the General Agricultural Extension Service of the Ministry of Agriculture.

3. Conducting an investigation of the prediction of scientific and technological development.

In order to satisfy the demand of the Eighth Five Year Plan, a program called "The development and the assumption of agricultural science and technology in Heilongjiang Province" has been carried out by us and the Northeast Agricultural College. This program played an important role in studying and working out a plan for the development of agricultural sciences and technology, outlining developing agriculture by means of science and technology, and helping the provincial government to make strategic decisions. This achievement was reported to the Provincial Scientific and Technological Commission.

4. Conducting an investigation of a comprehensive evaluation of technical economics.

In view of the important technical economic problems in agricultural production in our province, a series of problems such as "The quality of agricultural products," "The purchase price of soybean products for exportation," "The reduction of soil fertility in agricultural production," "Pollution of agricultural products by chemical fertilizers and pesticides" have been investigated through the cooperation of us and the departments concerned, and we have written several reports such as "Raising the quality of agricultural products and stimulating the development of commodity production," "The current situation of the quality of rice and the criteria of good quality of rice," "The competitive situation of the international soybean market and the countermeasure of soybean exportation in Heilongjiang Province," "The reduction of soil organic matter is a potential threat of the regression of soil fertility" and "The pollution of pesticides and chemical fertilizers and the countermeasures for their control." Some of them have been given to the provincial government, Standards Bureau to serve as a basis in working out plans and policies, some of them have been used in agricultural production, foreign trade and exploitation. For example, some recommendations such as the establishment of the Soybean Scientific and Technological Exchange Center, the Food and Oil Trade Center, and the Productive Bases of Special Purpose Commodities for Exportation, and the exploitation of different kinds of agricultural products, strengthening the purchasing of agricultural products, export inspection, storage systems and so forth have been carried out. According to one estimate, an increase of between one and two million dollars of economic income in soybean exportation every year and the loss of soybean will be decreased by 15,000 kg.

5. Conducting an investigation of agricultural scientific and technological management.

According to the demands of the reform of science and technology in the whole country, the program called "The study on scientific and technological reform in rural areas" has been assigned to us through the Provincial Scientific and Technological Commission, the subprogram of which called "The study on the reform of scientific research in rural

areas" has been carried out by us for two years. This "632 comprehensive scientific and technological system in rural areas" has served as a model for scientific and technological systems in rural areas of North China, after an appraisal made by the State Scientific and Technological Commission, and has won a prize for consultative achievement given by the Provincial Department of Agriculture and Industry of the Chinese Communist Party and a third class prize given by the provincial government.

In addition, a paper called "The mechanism and effect of scientific and technological achievements at the time of their extension and application" has won a prize from the Provincial Scientific and Technological Commission, and has been read in the National Symposium of Scientific and Technological Exchange.

C. Opening up new scientific information fields

1. Taking an active part in the projects of agricultural scientific and technological exploitation in the whole province.

Leaders in our academy have organized scientists and technicians to join the projects of agricultural exploitation in large areas. Scientists engaging in information research have supplied a series of scientific and technological information at home and abroad, have propagated and summarized achievements of investigations, and have spread advanced experience for three years. This group exploitation is an effective form of close combination of information, technique and production and plays the role of a bridge in transferring scientific technology to agricultural production. This cultural practice has been extended over 300,000 hectares in four years, has increased the yield of rice by 550 million kg, which equals 250 million Yuan. Therefore, farmers have increased their income by 180 million Yuan. This project has won a second class prize for scientific and technological improvement given by the Ministry of Agriculture. A booklet called *The cultural practices of high yielding rice* and more than ten articles have been written through the cooperation of us and other scientists. In addition, we have sent an expert engaged in the culture of edible fungi to join the Chinese Exploitative Group of Edible Fungi working on exploitation of edible fungi.

2. Actively extending new agricultural techniques and new achievements.

In order to extend new cultivars of corn, scientists in our institute went to rural areas to compose a combined unit of information and production, to provide services in the whole growing season and to produce 30,000 kg of the new hybrid seeds, Longdan 7, the acreage of which covers 700 hectares in the second and third accumulated temperature zones of our province. The corn yield has increased by 750 kg per hectare compared with local varieties. The total output of corn increased by 0.5 million kg. Farmers have gained 300 thousand Yuan of income. Besides, cultural practices of rice by means of throwing rice seedlings has been extended in our province. After its investigation, we wrote an article called "The current situation and development of cultural practices of rice by means of throwing rice seedlings," in which we propagated and reported this technique, and assisted farmers in buying agricultural materials such as plastic pans for growing rice seedlings, seedbed herbicides and seedbed acid regulators. By the end of

1988 the acreage of this new technique covered 3,300 and more hectares in the whole province. Rice yield had increased by 1,500-2,250 kg per hectare, the net income was 598.5 Yuan per hectare. The economic effect in the whole province reached over 2 million Yuan.

3. Taking part in the development of agriculture for exportation.

Since the strategic policy called "Ally our province with provinces in the South and open up to the foreign country in the North" was put into practice in our province, Chinese-Russian boundary trade and technical cooperation have been developed rapidly, the amount of exportation of agricultural, subsidiary and processing products is about half of the total amount of exportation of commodities. For this reason, we have conducted a program called "Studies on marketing of agricultural and subsidiary products and technical cooperation," and we have collected a lot of data for leaders and personnel going abroad. We have been in touch with many foreign trade companies, boundary trading ports, universities and colleges, scientific research institutes in the field of information and have collected a series of technical criteria on potato, soybean, corn and so forth for export, and submitted these materials to the departments which have sources of these kinds of goods. We sent two persons to the Soviet Union to make an investigation and look for works in translation. We have conducted training courses in the Russian language for training translators who shall be sent to the Soviet Union to work.

4. Manufacturing and developing new products.

In order to fit the demand of information propaganda, our institute established an electronic printing system to publish all journals, reports and papers of our academy and obtained a better effect last year. Our institute has undertaken a program called "Studies on the reasons for the decrease in soybean production in a continuous cropping system and countermeasures for its control." A preparation called yield-increasing agent for soybean continuous cropping has been manufactured on the basis of extensive investigation and consultation of a great deal of references at home and abroad. The results of experiments at more than twenty locations has shown that soybean yield when applying yield-increasing agent has increased by 9-16% or 165-300 kg per hectare compared to the control. The cost of this agent per hectare is thirty Yuan which is equivalent to the purchase price of 22.5 kg of soybean. It is convenient, safe and reliable in application. Now the Agricultural Bureau of Yilan County has asked to transfer this technique and to produce it jointly with others. In addition, "YemianBao," a plant growth regulator, made by Guangxi Chemical Engineering Institute was examined by our institute in the past two years. The effect of the increase of yield reaches 7-13%, which is not inferior to analogous products such as "Yield-increasing fungi," "Fengchan-su" and so forth. Its cost per hectare is only a few Yuan. It will be further tested and manufactured jointly.

5. Conducting propaganda of information and impartation of technical skill.

The achievements of research, new techniques and exploitative activities of our academy are always widely propagated by means of newspapers, radio, journals and so forth. In order to enhance our role in serving the rural commodity economy, we organized an information network of all businesses in villages and towns in our province, in which nearly a hundred units and persons joined these activities. All kinds of useful techniques, dynamics of marketing and information on how to get rich are introduced in the journal called *Information on all kinds of techniques to get rich for villages and towns*. Good varieties of field crops and vegetable crops, seedlings of fruit crops, chemical fertilizers, and pesticides are also introduced in it as a consultative service for the purpose of providing a proper choice for farmers. We have edited a corpus of articles about scientific and technological achievements for all specialized societies and institutions and helped them to compile practical technical materials such as booklets called *The cultivation of muskmelon* and *The cultivation of edible fungi* for developing the rural commodity economy.

III. Recommendations for developing information research

1. Strengthening the construction of agricultural information systems.

At present information research attaches itself to the administrative service department, resulting in its becoming a working model in which it is led by the leaders of several institutions, and is separated into pieces, divorced from agricultural production and it is decentralized, small and complete, and consequently it is not beneficial to strengthen leadership and unified management. It is necessary to set up a modern agricultural information system which is suitable to the development of a rural commodity economy, harmoniously developing with scientific and technological economy and society, rationally distributed and completely functional.

It is also necessary to establish a Bureau of Agricultural Information in the Ministry of Agriculture, which would provide dual leadership in administration and business and to form a network system to play the function of management, organization and coordination, to work out and accomplish the general plan of scientific and technological information, to reform the operating mechanism of information institutions and to stimulate their activities, to formulate a law of agricultural information and a policy of information research to improve all systems, to standardize the management of the achievements of information research, to raise the social status of information research and to pay more attention to determine programs, budgets and evaluation of achievements.

2. Agricultural information must actively throw itself into the main battlefield for the development of the rural commodity economy.

The aim of the reform of the Chinese scientific and technological system is to develop productivity, and to closely combine science and technology with the economy. Therefore, reform of the information system must proceed from national conditions, to set up an operating mechanism combining information with the economy and to transfer

the main battlefield to the service of economic construction. Information investigation is an important component of agricultural information business in China. It is necessary to play up the superiority of information research so as to give service to the working out of policies, the strategies and long-term plans of development, the development of agriculture with scientech, the extension of agricultural techniques, the improvement of productive conditions, the development of agriculture for exportation and the development of township enterprises. At the present time, it is necessary to study problems such as the reform of the agricultural economic system, the regulation of industrial construction, large-scale management, group contracts, combined units, the increase of the potential of agricultural production and the processing of agricultural products in order to provide a scientific basis for making decisions for leading organizations and institutions at all levels.

3. Strengthening the construction of battalions of agricultural information research.

Premier Li Peng pointed out that the extension of science and technology can not be developed without education and qualified personnel. For this reason, it is necessary to set up an on-the-job training center to build up a large number of newly qualified personnel who are well-developed in an all-round way, to arrange rational knowledge construction, to resolve the problem of knowledge renewal in order to raise the quality of scientists and the level of achievements.

4. Making information products into commodities.

According to the law of value of commodity production, it is necessary to put into practice the paid transfer of information products which serve as knowledge commodities, and their exchanges at equal value. It is also necessary to develop paid services in all directions through a series of channels and forms. The National Bureau of Information must work out an open policy to encourage the transfer of information products.

5. Raising the level of modernization of the information research environment.

It is necessary to strengthen the construction of data pools for information research, economic comparison of scientific and technological production and different specialties, and the construction of files for managing business, to provide computers, microfilm and office automation systems and to absorb advanced theory and methods of information research at home and abroad in order to combine published data with the investigations in situ, to combine the knowledge of experts with the experiences of the masses, and to combine qualitative research with quantitative. It is also necessary to organize the cooperation of many branches of learning and various departments in order to enable information achievements to have advanced and applicable character, and consequently to initiate new circumstances and reach a new level for information research development.

Joining the Main Front for Economic Construction to Open Up a New Aspect of Information Research

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Agricultural production, rural economy and agricultural modernization are the main front for agricultural scientists and technicians. As a component part of agricultural science and technology, agricultural information research should go to this main front to make a contribution directly to the socialist movement to open up new aspects of information research. It is a very important issue confronting information research organizations and their researchers, which relates to the orientation of agricultural information research. Our exploratory practices and viewpoints in this respect follow:

I. Advancing the meaning of going to the main front of agricultural information research.

(1) The extension of service area

Agricultural information research work needs to be extended from its service objectives of policy-making, scientific research and education to include agricultural production, rural economy and agricultural modernization.

(2) Diversification of the service focus

Diverting the focus of service to the promotion of agricultural development, rural economy and the construction of agricultural modernization, including:

- The coordinated development of agriculture, industry, and cities and towns.
- The control of agricultural stabilization, coordination and continuing development and their general and specific policies.
- Agricultural development planning and key sciencetech projects.
- Rural economic development and farmers' lives.
- Readjustment and improvement of rural enterprises.
- Research and extension of agricultural science and technology.
- Development of agricultural modernization.
- Improvement of farmers' education.

(3) Improvement of research methods.

The traditional method of agricultural information research was based on material resources and lacked on-the-spot investigation. As the focus of agricultural information research has diverted to serving the main front of agricultural production, the method of agricultural information research needs to be associated with spot investigations.

2. The necessity of taking agricultural production and the construction of agricultural modernization as the main front of agricultural information research.

(1) The eight hundred million farmers are the main focus for agricultural production and rural economic activities. As a result of the reform of the rural economic system, farmers now are not only the producers but also the agricultural managers. The establishment and development of a planned commodity economy in socialist countries mean a readjustment in the benefits at state, collective and individual levels. They also mean the interrelation, interaction and competition among producers and among sellers. Under this social condition, the people who want to win have to master information which is the key factor.

(2) The decision-making of agricultural departments at all levels is now diverting from an experimental type to scientific decision-making on the basis of accurate, comprehensive and up to date information research.

(3) Depending on science and technology is an important factor of agricultural production, the rural economy and agricultural modernization. In present times, the amount of scientific information is increasing rapidly and a great amount of information is mixed together including correct and incorrect, useful and useless. The main functions of information research are data collection, selection, summarizing and analysis according to the demands of users and user groups to form new scientific products which are the products of information research.

(4) The existence and development of information research work must go through serving the main front of economic construction to improve its capacity for existence and development and for serving the socialist planned commodity economy.

(5) The results of information research can achieve social and economic benefits which help promote the unity inside the information organizations. The value of information research can be changed as we change from theoretical analysis and dissemination into an objective existence as the result of scientific research. This is a leap in the concept of traditional library and information service and will be easier to be recognized, supported and evaluated by society.

3. The analysis of internal conditions and environments for information research work going to the main front of economic construction.

(1) External conditions.

1/ Evaluation of the demand of users. As mentioned above, the prospect is bright for marketing information research results from the developing trend of society's point of view, but at present, there is a significant difference between potential and actual demand for the results of information research. One of the reasons is that information consciousness is not well recognized by society. On the other hand what is more important is how to improve the quality of information research workers. As one part of the social consciousness of the people, information can reflect political and economic and cultural development levels of society. The aspiration to strengthen social information consciousness can be accepted, but its effect is limited. We can't strengthen social consciousness without limits and we can't wait either. We must face the facts and improve the quality and the level of information research to meet the demands of social development. This is the serious situation facing us.

2/ The evaluation of the competitive market situation for the information research. After the meeting of National Soft Science, the soft science research organizations came out one after another in our country. A large part of the work done by these organizations is similar to information research work. Some organizations in the agricultural field are:

- The research centers for rural strategic development range from central to local government departments at all levels.
- The research divisions for rural policy at different levels of the party committee.
- The research organizations for rural development set up by scientific committees and planning committees.
- The investigation and study offices in agricultural administration departments at all levels.
- The research institutes of agricultural economy, rural development and agricultural modernization in the Chinese Academy of Science, Chinese Academy of Social Science and Chinese Academy of Agricultural Sciences.
- The research organizations of agricultural economy and agricultural modernization in the institutions of higher education.
- The research organizations in the system of agricultural banks.
- Although the names of these organizations are not information research organizations, most of their work belongs to information research or is based on information research. These organizations have more favorable conditions for information research than most information organizations themselves.

- The researchers in these organizations understand every department, the intentions of the main officials and can grasp the whole situation, helping their research results to be expanded easily.
- The organizations have advantages in talented people and funds, and have more research activities because of the system.
- Their research results can be applied because the method of their work is not only dependent on materials but also on practical investigations.

(2) The evaluation of social adaptability of information research work.

There is a rich resource of materials in information research organizations and almost no other organizations can compare with it. They are provided with the ability and the method of researching, applying and analyzing material resources.

Better research results and experiments have been achieved after more than ten years of practice, laying a foundation for information research including social influence.

(3) The general situation.

Information research work is facing an opportunity to develop while the crisis and challenge still exist. If it is to exist and develop while serving the main front of economic construction, information research should pay more attention to the internal and external environment. The external environment is an objective existence which can not be changed but the internal environment can. The internal environment should adapt to the external environment in ways which will improve our work. The external environment can have a great influence through the information research work itself which reflects its adaptation to the external environment.

4. The considerations on how to open up a new aspect of information research work in the main front of serving economic construction.

(1) Strategic objective

On the whole, the organization of agricultural information research should put its main forces into the main front of agricultural development and strengthen its theoretical construction, its rank of talented people and its modernization construction to improve their service level and their adaptability to the social demand of information.

An information research unit should undertake and take part in research work in one or more subjects according to its condition, environment, and level so its research projects can be developed from lower to higher, gradually establishing its authority within certain limits to attract more users or user groups.

(2) Some methods and countermeasures for improvement of information research work

1/ Extending the service field to the basic level and industrial and agricultural production. Agricultural production, the rural area, and the farmers are the large user markets for agricultural information research to which more attention should be paid. A great amount of accurate and up-to-date information research is needed in agricultural coordination and development, agricultural policy, rural economy, development of agricultural production, planting and management of different crops, various social, economical and technological measures, and extension and popularization of agricultural technology.

2/ Changing traditional ideas to new ideas of users first and strengthening the competition consciousness. The results of information research must be evaluated by the users as any other product in a competitive market.

3/ Information researchers must have a strong information consciousness. The so-called "social information consciousness" is the product of certain developments in economics, science and culture in society. Without information consciousness, information researchers will lose their initiative in the work and their research results can not be satisfactory.

4/ The basic conditions for the existence and development of information research are the associations of social and economic effects.

Information research work possesses certain public benefits.

Avoid egalitarianism in internal management.

Taking project research as their main task, information research organizations can develop some new projects and business within its scope to make full use of labor resources and increase their income and research funds.

5/ Developing research theory and methodology are ways to improve the quality and level of information research results and are the critical factors in for the existence and development of information research. The practice of information research needs guidance under the relative theory and method.

6/ More attention should be paid to the recruitment of talented people into information research. This is the key factor for the success of information research. The competition of information research is actually a competition of talented people. Organizations which have talented people will have research projects and successful results.

Establishing a New System of Agricultural Information Technology, Production and Marketing, and Promoting the Agricultural Technological Development of China

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Abstract

Aimed at characteristics of the new requirements of agricultural information users, the paper analyzes the scope of agricultural information service, addresses the mechanism of transforming agricultural information into productivity, and its relationships with other key factors. The paper also puts forward methods in which agricultural information is involved in the process of agricultural technological reform, the organic framework of grass-root information service, network construction, and views on a comprehensive information service.

With the rapid development of commodity production in rural areas in China, the farmer's production and management techniques are being greatly changed, from purely seeking a high yield to increasing their overall economic benefit. Being guided by the market, more and more agricultural products have been put into circulation. Farmers conscientiously use market law to adjust agricultural structure and promote agricultural development and technological progress. Throughout the course of production, farmers have taken great interest in information on the market, production techniques, agricultural materials, agricultural product processing, resource development, economic benefit, etc. The countryside has become a big market for agricultural information, and farmers have become the biggest users of agricultural information. With the constant development of agricultural productivity, the users' potential will be deeply and widely exploited.

I. All-Round Agricultural Information Service

Grass-roots units below the county level and even the farmholders themselves are the main body for transforming agricultural technological information into productivity. According to the characteristics of agricultural development, we should study effective ways and means of transforming agricultural information into productivity, thus, promoting the transformation of agricultural information into productive forces more effectively. Recently the users' demand for information has displayed new characteristics; consequently, a new aspect of information service has appeared.

1. All-Round Service

Reform of the rural economy system in China is proceeding toward a higher level. Production is changing from scattered plantations to specialized ones and management is transforming from a closed form to an open one. Information demand and utilization have started to permeate throughout the whole process of agricultural production. Farmers have an urgent need for an all-around information service supplying such information as market circulation, new technique applications, guarantees of production conditions, pre-harvest, mid-harvest, and post-harvest data. For example, because of the farmers' demand for diversification, the Dahe township information station of Huailu county, Hebei province, made every effort to collect technical information on planting melons and vegetables. Using information on "the technique of cucumber cultivation in a sunlight greenhouse" they helped one demonstration household to grow 80 square meters of cucumbers in sunlight greenhouses, by which the farmer made a profit of 363 yuan in one season. This technique was swiftly extended to 6.7 hectares in the whole township. Farmers' income was increased and the vegetable supply in the city was enriched. They introduced fine varieties and imparted advanced cultivation techniques to the farmers. They purchase plastic-film, greenhouse materials, fertilizer, pesticides, etc., and sell them to farmers at a favorable price. They sent full-time information personnel to Beijing, Tianjin, etc., to investigate and transmit the market situation there and helped farmers sell more than 10 million kg of watermelons, which is about 40% of the total output, increasing income by 2.5 million yuan. Through all-round information service, they have successfully transmitted research achievements to farmers, accelerating the transformation of information and technology into productive forces.

2. Integration

In the course of specializing their production, farmers have united voluntarily to form more flexible and more vigorous economic cooperative organizations, such as the various farmers' societies or rural associations. They form liaisons with colleges and universities, research institutions, supply and marketing departments, and establish contacts with individual farm households, forming a main bridge to provide scientific information and advanced techniques to the countryside. Up to now, more than 90,000 such associations have been formed throughout the country, spreading over more than 140 professions such as field crops, poultry breeding, animal husbandry, aquatic farming, processing, special products, etc. Lu Guoxin, a farmer in Hejian county of Hebei province, together with twelve other cotton-growing households, set up the Guoxin Cotton Research Society. The society constitution, which promotes self-service, mutual benefits, and bearing risks together, was formulated and they established close information and technological ties with Beijing Agricultural University, the Hebei Academy of Agricultural Sciences, and the Institute of Cotton, CAAS, etc. The society provides its members with the latest information, new technology, fine varieties, necessary materials, and service, and guarantees a member's production and a market for his products. This has brought about encouraging economic results for members. Because society members adopted suitable varieties of high quality and high yield, cotton yield per hectare was 30% higher than that of nonmembers, and the price per kilogram of ginned cotton is 0.4 yuan higher than that of nonmembers. The seed was sold as fine

varieties at a price of 1.6-2.0 yuan/kg. Net income per hectare is 8,916 yuan, which is 100% higher than nonmember's. Integrated services have exerted a strong attraction to the farmers, and now the members of the society have increased to 1,300. They take information as a guide, science and technology as the backing, and supply and market demand as the support, having opened a new way to integrate production, supply and market demand for the development of commodity production.

3. Specialization

Farmers yearn for a specialization of agricultural service. They hope materials and their products can be supplied and sold promptly just by a telephone call. According to statistics, there have already been 1,765 various agricultural technical contracting groups in Hebei province. They have contracted 2,577,000 hectares of wheat, corn, rice, cotton, melons and vegetables, fruit trees, etc., and have achieved significant economic benefits. A standardized wheat cultivation group of Cixian county contracted 80,000 householders' 17,000 hectares of wheat in 1987. Consequently, yield per hectare reached 4,590 kg, 22.4% higher than that of the previous 3-year average. Specialized services have laid a solid foundation for the socialization of production.

II. Establish a New System of Information, Technology, Production, and Marketing

The household production contracting system in rural areas of China is an organizational structure based on the individual farm household. Rural information and technical services for thousands of individual farm households, transmitting information, promoting technical progress, and forging communication links, have formed a new system of information, technology, production, and market, which can be adapted for the rural development of our country.

1. Network structure and its supporting system in the new system.

The new integrated system of information and technological service below the county level has the county service center as its core, the township service station as its backbone, the village service group as its basis, forming a 3-level network of information service. Information contacting households and technical demonstration households are used as examples to form the supporting system. The responsibility of the county service center is to collect various pieces of information, to distribute it to appropriate towns, to introduce adaptable techniques, to train information personnel for town or village and to purchase the necessary means of production. Township service stations take the information issued by county service centers, and hand it out to farm households directly, and train and guide the contacting and demonstration households, providing the households with the contract-stipulated means of production. Village service groups carry out low-charge specialized service, such as distributing fine varieties, tractor-plowing, fertilizer preparation, chemical weed control, disease and pest control, irrigation, harvesting and threshing, etc.

The two kinds of households (information contacting households and technical demonstration households) play a leading role in the development of rural commodity

production, and are an important crux of the network. They first adopt the new information and new techniques. Experimental projects of research institutes are undertaken by the two households first. Only after that are they popularized and extended among all farmers. Dahe town of Huailu county, which includes 16 natural villages, has set up 35 township contacting households, 175 village contacting households, and 220 technical demonstration households, having formed a well-informed, criss-cross network of information and demonstrations. In 1988, just by transmitting useful information, they brought about economic benefits totalling as much as 2.98 million yuan.

2. The characteristics of the new system

The new system is an inevitable outcome of the deep development of the households production contracting system. From its very beginning, the new system has being interrelated with rural economic development, and has been closely linked with farmers' demand. So it has a solid foundation and great vitality. In practice, it is continually being replenished, perfected and strengthened.

(A). The source of information varies. County service centers have a wide range of information sources. They can select adaptive information accordingly in the light of the characteristics of local resources. The Huailu county service center obtained ecological information of the Zhang Jiakou Pastoral area from related departments. They transmitted information on developing livestock farming to related towns and villages, considering the preponderance of hilly area and the abundant forage grass in the county. They helped farmers acquire credit funds, purchase 22,500 feeder cattle from Zhangbei county, and fatten them in this county. As a result, large numbers of cattle-raising households emerged in the poor hilly area, thus opening up a new way for farmers to make money.

(B). Know the technology. Transforming information into productivity is bound to be involved in the process of changing technique into materials. County and township service centers or stations concentrate information and technology into a single body to conduct technical consultation, guidance, training and operations at any time. They are versed in both theory and practice, and well-received by the masses. Having grasped the information of plastic film mulching cultivation for corn, the Fengning county service center has continuously run a technical training class 515 times, showed videotape of the technique 49 times, printed and distributed 12,000 copies of the technical data, trained township and village technicians totaling about 77,400, and held a number of on-the-spot meetings to demonstrate the technique personally. Consequently, the technique was extended to 163.3 hectares that year, the yield amounted to 10.8 t/ha, which is 40% higher than that of conventional methods. Thus, a new yield-increasing method had been discovered for corn production in cool highland regions.

(C). Emphasize practical results. Agricultural production has a close relationship with the performance of county and township service centers or stations, which has become an important criterion in measuring their working achievements. Therefore, they share a common aspiration and goal with the farmers and take high quality service as their

objective, and provide farmers with a convenient, satisfactory and beneficial service, rather than making a profit from them. In order to assure the steady increase in use of plastic film mulching in corn planting, the Fengning county service center had made 195,000 kg of fine varieties, and purchased 153 t chemical fertilizer, 1.9 t pesticides, 32.6 t plastic film, and 111 pieces of farming implements to sell to farmers at a favorable price, making the farmers feel that not only is the information available, but also the means of production and appropriate techniques are guaranteed.

3. The new system has showed great vitality in practice.

The agricultural information and technical service system and network below the county level are emerging, and will be developed and improved continually in the course of production. At present, 92% of the towns in Hebei province have established all-round service organizations, in which 50% of them have attained the standards of the "Four Necessities" (i.e., organization, personnel, information, business). More than half of the villages have set up service groups, and most of them have reached the standards of the first "Three Necessities" (i.e., organization, personnel, information). In the whole province, 110 counties have established information contacting points, contacting households, and demonstration households, accounting for 73% of the total number of counties and cities in the province. The number of rural information contacting points has increased to 11,250, and the number of information contacting households 100,000. There are 72,800 people engaged in agricultural information service at grass-root units below county level, of which 3,732 are well-educated (possessing a college or polytechnical school diploma). Through various means, more than 20,000 agricultural information personnel have been trained. Their professional ability has constantly improved. Thus, an important force for promoting agricultural technological development has been formed.

The agricultural information and technical service center of Wuqiang county, Hebei province, learned that Tianjin trading port would export large quantities of chili. So they signed a contract with the Tianjin foreign trade department to export 55,000 kg of chili, thus opening up a profitable endeavor for farmers of the county. By means of broadcasting, holding rallies, putting up blackboard newspapers, printing information, etc., they propagandized information on enriching the chili crop, the world market for chili, quality and standards required, cultivation techniques, harvesting and processing technique, etc. In addition, they established a chili grower's dossier, to provide appropriate pre-harvest, mid-harvest, and post-harvest service. The total output of chili amounted to 125,000 kg, and the total income 300,000 yuan RMB. The economic benefit amounted to 200,000 yuan RMB. The service center received 3,000 yuan RMB as a service charge, for the purpose of expanding its own service forces. For another example, Li Pingfen, an agricultural information specialist at Chang Zhuang village of Anguo county, set up an information service station for medicinal herbs. She published fifty issues of *Information from the Medicinal Capital of China*, including information on making profits, the market situation, trend forecasting, cultivation techniques, etc. Readers can basically grasp current information on production, supply and marketing, cultivation and processing of medicinal herbs. Huang Zhenhe, a farmer at Huangjia village in Buoxing county of Shandong province, learned from the 40th issue of

Information from the Medicinal Capital of China that *Typha angustifolia* L. was in short supply. So, using local resources he collected and processed 4,000 kg of *T. angustifolia*. With the help of the information station in selling, he made a net profit of 27,000 yuan RMB. This information station employs a total of about 340 information personnel. Making full use of their information resources, they helped farmers sell 1,200 million kg of vegetables, 50 million kg of watermelons, 0.5 million kg of strawberries, and 200 million potato seedlings in one year. The economic benefit is 100 million yuan RMB. However, they only received 30,000 yuan as a service charge. What is taken from the people is used in the interests of the people.

In Hebei province, this new emerging trend has been fervently supported and properly guided. In the whole province, 10 prefectures and cities, and 23 counties have been equipped with microcomputers, which have laid a solid foundation for the modernization of grass-root agricultural information services. Some counties have also established guidelines such as: "rules of agricultural information service," "rewarding rules of agricultural information service," "assessing methods of agricultural information service." Therefore, the development and improvement of the new system and network are ensured. In the rural area of Hebei province, transforming agricultural information into productivity is being accomplished before our eyes in an entirely new way.

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On the Transformation of Agricultural Scientific and Technical Information – Thoughts on Transforming Information into a Productive Force

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Abstract

This paper discusses two theories on the transformation of information into productive forces. It proposes to strengthen the role of agricultural scientific and technical information and to realize the transformation of its work: information production is the entire process from producing information products to their being used. The process of transforming information into productive forces needs to undergo a course in information commercialization. The role of agricultural scientific and technical information is no longer that of a single public welfare facility. It will surely change into information production. The main way of realizing these changes is to strengthen the capability of agricultural scientific and technical information, such as perfecting system construction, strengthening document work, paying attention to using and popularizing achievements of scientific research, and coordinating special education with a reasonable policy of science and technology.

Agricultural scientific and technical information work is an important part of the whole range of scientific and technical information work in the entire country. At present, the information factor in social and economic activities plays an increasingly important role along with the high development of our science and technology. Information has been accounting for an increasingly larger proportion of the economy. This is a new situation which is taking shape in our country. Thus, the information specialists in agricultural science and technology should progressively broaden their activities in information to support a technological economy, commodity production, market and management science, etc., while they continue to strengthen the information work of production technology and attach importance to the information of a growing industry. The information of agricultural science and technology should be transformed into productive forces directly, efficiently, and at high speed.

I

From an information science point of view, there are two forms of achievements in information production. The first form is to achieve its own material existence. The information product of the first form is an ordered information collection. It is substan-

tial knowledge. The information products can be divided into 1st, 2nd and 3rd level products in accordance with the information production or level of processing. The first information product is the original information which has been produced through the activities of scientific research, production management, etc. The second information product is what we have gathered, selected, arranged and organized on the basis of the first information product, e.g., abstracts, indexes, bibliographies and various kinds of databases. The third information product is the achievement resulting from the selection, distinguishing, analysis, synthesis and concentrating of the first and second information products. The second form is the useful effect created and produced by information workers. The labor achievement we mention here is a form of expression of living labor achievement, we can call it "the information consultation service" or "information service."

The first form of an information product is involved in agricultural scientific research. Through processing, the information itself is not only a creative scientific achievement, but also is a promotion of the scientific creation. This view has been verified by the practical activities of intellectuals and scientific researchers who create and gather information. This would make the laws of nature, society and human thinking understandable, and meanwhile change and accelerate scientific research. On the other hand, to attain their aims, scientific researchers grasp natural laws through information. In scientific experiments, we can say humans make use of the 1st, 2nd and 3rd information products to create a 1st information product of new knowledge and new information. When the labor achievements of information production become matter, in connection with practice, they create real productive forces, and this will accelerate economic development. Agricultural science and technology is a potential productive force of knowledge information. Its application in practice is closely related to intelligent and active labor, which is the second form of information production (information service). Information producers' useful effects lead the combination of agricultural scientific achievements with productive practice. This will make production economical so that it creates a direct productive force, and accelerates economic development.

Although a general accounting has been given above to information production and its transformation into a productive force, we should understand the socio-economic background for information production and the methods for transforming information achievements into productive forces with this kind of background, so that we can know the connections between information production and society.

With the founding of our country's planned commercial economic system and the development of news techniques, the economy and scientific technology are connected more closely and they are more dependent on each other, so the era of information research being limited to the field of scientific technology has passed. Now people are aware that information is a necessary factor for their scientific research, design, production, management and sales. Thus, we should have a proper estimate of the value of information. Like other scientific and technological achievements, scientific information achievements are also creative products and results of intellectual work. It is of value and can be changed into a productive force if it is used in production. With the

appearance of the technical information market, scientific information in different forms has entered the markets for trade (exchange). When it is used by users, it can yield certain social and economic profits. One point should be made, not every kind of information can be a commodity, e.g., information provided to leaders and other public information products. Nevertheless, it can also be transformed into a productive force indirectly and make gigantic social and economic profits.

As indicated above, information can be commercialized and its nature is to change knowledge into direct productive forces. So we can conclude that information will be a main productive factor in modern socialized production systems, just like land, labor, and funds. Obviously the situation needs documentation and information work, which are important parts of scientific research, and are productive characteristics. Documentation and information work used to be regarded as the management and storage of books and materials and theoretical research within scientific research institutions. This view is fairly far from the above requirement. According to the latter point of estimating the present situation of agricultural scientific and technical information work, not only is the level of applications for information achievements low, but underdeveloped across all agricultural scientific research work. To make agricultural scientific technology information work fit the demand of economic and scientific development and have the force to accelerate social economic development in a commodity economy, we should enforce the functions of agricultural scientific and technical information work along with deepening information reform.

II

To enforce the agricultural scientific and technical information function is to ensure the systemic function of information production and research and gradually make agricultural scientific and technical information work get onto the right track of social and economic development.

1. To reform the system of agricultural scientific and technical information and perfect its moving function.

The key to reform is to change some shortcomings of the present system. As for the internal structure of our organization, its form is unitary and therefore attention is drawn to the research of information but not the production of information. To reform the internal structure of our institutions, we should reorganize on the basis of division of work in information production and research. The production division in our organization produces both information products and exports information service. It

should be stressed that following the transformation of knowledge into a tangible value in the form of information, the information service is extended to the reproduction of information production. So we should pay attention to it. Besides general information interflow and retrieval, we still engage in information analysis and research in relation to the economy and society. We can also regard this kind of analysis work as a modern service for policy making. Therefore we should set up special research departments of information and form reasonable

agricultural scientific information institutions with information production divisions. Our task is to set up perfect database

and information service networks, so that we can bring the dominance of information stemming from library-stored books and news resources into play in our work, and make use of all kinds of modern methods to study, develop and use documents. That is, we should not only provide plentiful and valuable information products, but also be ready to establish databases and open up many ways to collect rural economic information. It is necessary to issue periodicals with articles about rural policies, science and technology, economic information, etc.

2. Documents work – the main part of enforcing information work.

The documents work we mention here is not books and materials storage and management as usual, but refers mainly to information production, that is to say, work engaged in books and periodicals collecting, processing, quotation, indexing, and establishment of all kinds of databases, information services, etc.

For a long time we have over-emphasized the study of information and ignored documents work. In fact, information investigation and research would be very difficult if we completely ignored documents work. If agricultural scientific research personnel engage in information investigation and research and information personnel only do some coordination work, perhaps it will accelerate the development of information, scientific research and production, and yield a high economic profit. In this way, agricultural scientific information work can avoid obstacles in development which have been caused by the existence of too many focal points.

At present, our country's planned commodity economy has attained great achievements. As a special commodity, information products which are joining in exchange have been efficiently used in practice. So the work of agricultural scientific and technical information has not only a public cause developed forward, but information products tend to industrialization. Undoubtedly, our present enforced documents work has made a solid foundation for the future information cause. We can foretell that agricultural information personnel will pay more attention to set up a database, and develop the investigation and analysis work for databases that suit the agricultural scientific research and production situation of the region, and begin the systematic design for establishing a database so that the center of agricultural scientific and technical information of this region is built.

3. Paying great attention to the first information products and their transformation into a productive force.

Agricultural scientific research (which is a result of creative research activities) contains the common work of scientific and information personnel, just as we mentioned at the beginning of this paper. Usually we only notice the results of scientific research, and ignore the economic profits made by information. One phenomenon is that the first information product can be effective for users only through its service and need not be processed. Previously we only emphasized that the first information products were

created by scientific personnel, and ignored the information personnel's service in producing first information products. In fact, the role of information personnel should be brought into full play all the way from the production of a piece of the first information product to its application.

Generally speaking, the direct and indirect service of the production and application of the first information is the weak link in the work of agricultural scientific and technical information. According to our investigation, the rate of application and popularization of new agricultural technology in our country is about 30%. We should closely connect information service with the popularization and application of scientific achievements. This will make a new way to directly transform information into a productive force.

In order to make the work of agricultural information in scientific and engineering fields highly effective in serving the transformation of the first information product, we must open up more fields of information service.

a. We should develop the work of material information and gain the information through materials, for instance, the reports of research, video, photographs, and the exhibition of new technology and new varieties, etc.

b. We should use computers to set up special subject databases and serve scientific research and production.

c. To reduce links for transformation of the first information products. We should use the information publication to introduce and report on the scientific researchers, as well as what they are engaged in and have achieved in their research work. We should let the scientific workers get in contact with users to make the scientific research workers play an active role in information dissemination, so that the achievements of scientific research can be put into production more directly and quickly.

4. To strengthen the education of agricultural scientific and technical information specialists, formulate a reasonable policy for scientific and technical information work.

At present, most of the agricultural scientific and technical information workers are from the various fields in agricultural science in our country. They haven't been specially trained in a systematic way in information science, though they do have some special knowledge, technical ability and practical experience in information work. So, we must build up a contingent of fine workers in agricultural scientific and technical information. At first, they should enhance their knowledge of information science and library science, etc. In the meantime strengthening their training in technical ability and skill according to each person's work. We should also devote much attention to training information workers about information consciousness. Second, the workers should be educated in information science within the whole of agricultural science and research institutions. It is also necessary for workers from other research institutes to be educated in information science. This has an important bearing on the production

and use of information products which we should not overlook. The information unit is in charge of their study of information science. They must emphasize the training of technical ability and skills.

An Effective Way for Transforming Scientific Information into Productive Forces

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The basic elements of a productive force are the labor force, and a means of production. What is the relationship between science and technology and these basic elements? Historically, the means of production has been combined with science and technology, in the same manner, the labor force should be comprised of those who have mastered certain scientific and technical knowledge.

There are five factors in transforming scientific technology into productive forces:

1. **Scientific research**--each new invention begins with research.
2. **Applied technology**--research of applied technology turns raw science into products and overcomes problems, such as materials, methods, productive technology, and rules of operation.
3. **Rules of operation**--establishing the rules of production and technology for extension.
4. **Key facilities**
5. **Technical training**--people should master technical skills to be able to operate tools.

With these five factors, new scientific achievements can become productive forces and create new wealth for society. All these aspects should be linked together and taken on by all involved personnel to form a large system for transforming scientific research into productive forces.

Each link will engender numerous documents which will require rapid dissemination. As is well known, the development of science and technology is a worldwide concern. However, there are a number of barriers to scientific exchange, such as: language, specialization, geography, psychology, technology, policy, and even barriers relating to mode of thinking, etc. It is left to information personnel to surmount these obstructions. So we also denominate information as being the "active knowledge." In this article we will review an effective way for transforming scientific information into productive forces.

Scientific information presupposes practical needs. The scientific and technical development situation in China determines the administrative levels and need for information.

China has a large population and her economy is underdeveloped. In recent years, the total output value of industry and agriculture has been increasing, but compared with advanced countries of the world, we still have a long way to go. After summing up both positive and negative experiences in scientific and technical development, the government put forward a basic task which pointed out that the development of science and technology should be well-coordinated with economic and social development. According to this strategy, in developing science and technology we should stress improving traditional enterprises. The methods are as follows:

1. Use new technology to improve traditional enterprises. Scientists should understand the relationship between scientific advances and industrial development and structural changes, and define technical development and equipment policies.
2. Select and develop new and high-quality technology, such as information technology, biological technology, new materials technology, space and nuclear technology, marine engineering, etc.
3. Develop and extend suitable and necessary technology, and support the local economy; which means to develop small-town enterprises, and carry out the "Spark Fire Plan." Scientific institutions should use existing domestic achievements to promote their application in commodity production.

There are three aims for the plan: training young people in the countryside; developing complete sets of technological equipment for production; helping and establishing small business of technical demonstration.

There are five tasks of development:

1. Energetically extending industrial production technology in raising poultry and aquatic birds, aquaculture and animal husbandry, increasing production yield and reducing costs, increasing product quality and productivity.
2. Organizing the power of science and technology to develop agricultural products, processing technology and equipment.
3. Improving village living conditions and prolonging the life of cultivated land.
4. Extending new textile technology; improving the quality of printing and dyeing; increasing the varieties of design; expanding export capabilities.
5. Training lead personnel and technicians in developing small-town enterprises.

The purpose of this strategy is to create suitable conditions, improve investment potential, reform the personnel system and give full play to the technical market and management system of scientific research. To achieve these purposes, the scientific research system should be reformed by relying on scientific and technical advancement, and establishing a new system to ensure that the national economy can grow efficiently. The important steps are to develop a market system, a social technology supporting system, an information management system and a policy and law regulation system.

1. To develop the technical market, promote the transformation of research results into commodities, create favorable conditions for improving the old scientific and technical system.
2. To reform the funds allocating system for scientific research institutions, carry out systematic management based on kinds of scientific and technical activities, support the best research units and overcome equalitarianism.
3. To regulate the organizational structure of the scientific and technical system, encourage the combination of research and design institutions with production organizations.
4. To readjust and reform the system of agricultural science and technology.
5. To pay attention to the development of scientific research when we establish new scientific and technical systems.
6. To expand the right of scientific institutions to make independent decisions.
7. "Opening to the outside world" is a long-term, basic policy for developing science and technology in our country.
8. To improve the administrative system of scientific and technical personnel.

The technical market is an important information medium for transforming science and technology into productivity and the prerequisite is to develop appropriate techniques.

Technical development is involved with some activities of transforming research results into products, which include market investigation, technical calculation, scientific and technical research, technical design and technical evaluation, etc. Technical development should consider the advancement of technology, as well as "market value" and "economic efficiency." By doing all these, it will be possible to transform scientific and technical information into productive forces.

Broadening the Media of Communication of Agricultural Information and Its Role In Agricultural Development

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The Branch Center of Central China's Regions, China's AGRIS is attached to The Institute of Information for Agricultural Sciences and Technology, Hubei Academy of Agricultural Sciences in Wuhan, China. The Institute has stored about 100,000 documents in its library. Each year we acquire about 8,000 additional documents including books, periodicals and various abstracts and bibliographies both by subscription and exchange. Recently, we have installed a Sony video tape recorder, a Xerox machine, several typewriters, and have set up an offset lithography printing plant with a laser printer, and editing and type-setting computer system. We also have a PS/2-50 microcomputer provided by International Development and Research Centre of Canada in 1988. We are now using this advanced equipment to provide information service to our users.

In order to develop and utilize the information resources effectively, we try our best to broaden the media used in the communication of agricultural information and to provide active information services instead of passive service as in the past.

I. BRINGING PERIODICALS, NEWSPAPERS AND RADIO/TV INTO FULL PLAY AND TRANSMITTING INFORMATION RAPIDLY AND ECONOMICALLY

The Institute issues two kinds of publications: one is periodical and the other is non-periodical. The former includes *Journal of Hubei Agricultural Science* (Monthly), *Farmer's Advice*, *Information of Agricultural Science and Technology*, *Latest Bibliographies* and *Bulletin of Agricultural News Forecasting*. Besides reporting new findings and results on scientific studies, there are several columns such as "A Collection of Choice Specimens from Sciences and Technology," "Abstracts of Science and Technology," "News of Science and Technology," "Reviews of Literature," "Business and Management," "Policy and Law," and "Technique Transference." A lot of information is reported in these columns. The non-periodicals are as follows: *Brief Reports of Scientific Research*, *A Collection of New Achievements in Agriculture Research*, *Reference for Agriculture*, *Annual of Scientific Research*, and *Brief Reports of On-going Research Projects*. More than 10,000 information items are transmitted to our users annually through the media mentioned above. Some informative news has been transmitted to

users by the provincial broadcasting station or TV. As soon as new research achievements or technology have been reported, they are rapidly applied to agricultural production. For instance, a research article titled "Double-Transplanting Seedling of Late-Seasonal Hybrid Rice by Dry-Seedling Casting and Lodging" was published in *Journal of Hubei Agricultural Science* a year later, this new rice growing technology has been extended in Hubei Province and the growing area was 76,933 hectares by using the new technology and in the third year the growing area had been doubled. At the same time this new technology has been extended to Jiangsu, Anhui, Henan, and Guizhou provinces and worthwhile social and economic benefits have been gained. For example, 9,800 hectares of rice has been grown in Yangxing County using the new technique in the past year and the rice yield has increased by 6.85 million kg in the whole county.

We also use the column "Information Window" in two major newspapers in Hubei Province, one is *Farmer's Friends* and the other is *Information for the Countryside*, and one separate publication *Advice for Farmers* - to transmit information. Each year about 5,000 bibliographies on agriculture are published in the two newspapers. After the bibliographies have been published, many users come or write to us to acquire the full text articles. According to statistics made by the Editorial Department of *Information for the Countryside*, 436 bibliographies have been carried in one of the newspapers mentioned above from July to December in 1988. These bibliographies were used by 886 people. Some users even travel more than 1,000 km to our Institute to get the full text articles. Now let us take Xiaogang Farm as an example. A grass plant whose straw can be used for making mats, is grown on the farm. The straw yield of the plant is very low due to infection by disease. After the farmers of the Xiaogang Farm got titles of two papers--"Occurrence and Control of Blight in Grass Plants Which Straw Can Be Used for Making Mats" and "Technology of Growing A Plant Which Straw Can Be Used For Making Mats," they quickly got the articles in full text from us and then used the technology which the two papers explained in growing the grass crop and controlling its disease. As a result, the yield of the grass plant doubled and the farmers' income has been increased by exporting the straw.

Besides printed products, we also try to cooperate with the Hubei Radio Station and the Hubei TV Station, so that more and more agricultural information and news is available to farmers and other users over radio and TV. Each year, more than twenty sets of video tapes or films concerning new technology or achievements in agricultural study have been shown on TV. By doing this, farmers in remote mountainous areas have more chances to get information and learn how to use new techniques in agriculture production. For example, within only one month after a new compound fertilizer N-FIX N.S. was reported through broadcasting, 150 farmers wrote to us and asked for its price and wanted to know where to get it and how to apply it. This new fertilizer has now been applied to large areas of vegetable crops.

The facts have proved that periodicals, newspapers and broadcasting or TV are still the main and most effective information transmission media in China today under conditions of non-advanced communications technology. The results of an investigation of

200 users have shown that 80%, 90%, and 98% of information is gained respectively from periodicals, newspapers or radio/TV by agricultural scientists, extension persons and farmers. Other statistics show that information about new achievements and new products is spread widely by the mass communication media.

II. PROVIDING INFORMATION SERVICE THROUGH SDI: SELECTED SITES AND SELECTED USERS AND TRANSMITTING INFORMATION DIRECTLY

Providing the service of SDI, selected sites and selected users is an effective way to replace the previous passive service. This type of service has the following characteristics:

- Information that we provide to users is needed by users.
- Information needed by users is available very fast.
- We give users not only information, but also some materials or products such as new fertilizers, new pesticides or seeds.
- We can obtain feedback from our users quickly and improve our service at once.

In providing the three types of services, the main methods we use are as follows: first, we select the right topic, the right service sites and the right information users then discuss and make plans for accomplishing it together with the users including agricultural scientists, technical extension specialists and farmers. We often attend the meetings held by scientists and do field experiments with them. By doing so we know what users really need and we can improve our information service to them.

The SDI service is mainly to serve agricultural scientists who are seeking information to meet their academic requirements. First, we provide the scientists with a scientific basis for proving their selected question for study; Second, during the time the scientists are doing the study, we meet their academic requirement in a timely manner. In the past two years 1,200 bibliographies, abstracts, and full text papers have been made available to ten study groups. Research methods for five key questions under study such as "Technology for Growing Barley for Animal Feed" and "Growing Technology for High Yield of Hybrid Rice" have been improved due to our SDI service being available to them. The process of studying four questions such as "Study on Plant Photoperiod-Sensitive Genetic Male Sterility" and "Study on Microelement Deficient Disease in Soil" has been shortened after the scientists gained new insights from the information which we gave them.

Senhu Farm of Hanchuan county in Hubei has been chosen as one of our selected service sites. Besides having about 360 pieces of information in written form or materials available to them each month, we also send information specialists to investigate the local production and carry out some projects jointly. New varieties have been extended on this farm. For example, a new high yield corn variety "Danyu 13" has

been grown on the farm on 26.6 hectares and the corn yield has been increased by 25,000kg. Through investigation we found that edible oil is in short supply due to the low yield of sesame plants grown in Yun County. Then we did some information searches in the literature in order to find some new cultivar of oil seed for the farmers in this county. Finally we have found that perilla seed which not only has high yield, but also contains a high content of oil, is an optimal oilseed. The seed can be used instead of the sesame seed. Then 400 ha of Perilla was grown on a farm. Through this experiment we have found that Perilla is one of the oilseed crops which would have a potential future in the county.

Selected users service is a service in which some specific information users are selected and then we give them information service at regular intervals. Besides this, we also send technicians to help farmers perform field experiments by using a new technology or new varieties. After the experiment is quite successful, new technologies or new varieties have been extended to large areas.

III. RUNNING SPECIFIC TRAINING COURSES AND CORRESPONDENCE COURSES IS MORE ECONOMICAL AND A FASTER METHOD FOR THE TRANSMISSION OF INFORMATION

We analyze and evaluate some useful and selected literature. We also collect and disseminate materials which carry information urgently needed on the information market, or have a potential future in agricultural production, or can help farmers to get money quickly, such as some papers concerning new technology, or new cultivars and products. Finally these materials have been compiled into technical manuals or guides. Then we run training courses or correspondence courses using the manuals or guides as teaching materials.

In the most recent two years, we have run seven training courses, such as "Raising Techniques of Pearl Chicken," "How to Use Pig Feed-Additives," "Integrated Prevention and Treatment of Chicken Diseases," and so on. About 1,000 persons attended the training courses. Persons use the technology learned from the training courses in agricultural production. By doing so, they not only gain a financial benefit, but also play an important role in local agricultural production. For example, after the farmers have learned techniques about feeding pigs with the additives from the training courses, they bought five tons of feed additives for pigs from Wuhan Feed Additive Plant at once, and fed the pigs with the additive in the pigs' daily diet. As a result, 10,000 pigs which were fed with the additive have increased their body weights very quickly and have been sold out forty days earlier than those not fed with the feed additive. The pig farmers' income has been increased by 1 million Yuan.

IV. SETTING UP AN ORGANIZATION FOR DEVELOPING INFORMATION SERVICES AND HIRING PERSONS FOR EXTENSION ARE IMPORTANT MEASURES IN TRANSMITTING INFORMATION EFFECTIVELY

In order to bring the collected information into full play, an Department of Developing Information Service was set up in our Institute in 1988. Based on the principle of self-willing and mutual benefit, we employ 25 technicians in charge of extending technology and new varieties. These 25 persons hold two or more posts concurrently. Some of them work in local government organizations or do research work, most of them do technical work on farms. We acquire the information materials and then analyze and evaluate them. Through evaluation, some information materials concerning new and practical technologies or products or new varieties which have a potential future in extending or can help farmers to get money quickly, have been chosen. If it is necessary, some new technologies or real products or seeds of new cultivars have been introduced. Then we ask our persons in charge of technical extension to do the field experiments and demonstration work, finally extending them to large areas. According to how much is gained by the farmers, we charge them and pay money to the people in charge of the extension work hired by us. Both the farmers and persons doing the extending work can get benefits from it. In recent years, we succeeded in technical extending work. For instance, we got news from Information of Guangdong Science and Technology that a new chemical produced by CIBA-GEIGY Corp. in Switzerland is very effective in debudding of the tobacco plant. Then we got the new chemicals and asked a person who is responsible to do technical extension work to do the field experiment with it in Xiangfeng County. By doing the experiment, we have found that the chemical is very effective in debudding the tobacco plant. In 1989, 200kg of the chemicals have been acquired and applied over 1,333 ha. of tobacco plants. As a result, 8,000 laborers who are traditionally used to debud tobacco plants have been saved and the income of tobacco growers has been increased by 1.34 million Yuan. Our Institute and persons who did extending work got 10,000 Yuan from tobacco growers using the chemicals. In 1988, we knew from *Pig International* published by Watt Publishing Co. that the medicine "Gleptosil" produced in the U.K. is very effective in treating piglets anemia, increasing the survival rate of piglets, promoting pig's growth and increasing their body weights. We got the medicine and asked our technician to do the experiment on our Academy Farm. The body weight of each piglet which received an injection of 1 ml of the medicine increased by 3kg three days after it was born compared with an injection of Iron (Fe) or Cobalt (Co) produced in China. Then the Department of Developing Information got 300,000ml of Gleptosil and extended it to several counties in Hubei Province. We are expecting to increase pork production by 900,000kg, and economic income by 5.1 million Yuan in these counties.

Information we have collected is generally in written form. If it is necessary we introduce new technology or products from other provinces or abroad. If some new products are not available on the market, we will try our best to develop them. That is our procedure for materialized information. For instance, the Department knew from "The Catalogues of Patents in Agriculture, Animal Husbandry, Fishery, Sidelines and

their Products Processing" that a feed additive for silkworm produced in Japan is very effective in increasing the silk cocoon yield (30%). Through searching the literature, we have found that this feed additive is not available on the market now. At present we are trying our best to develop and produce it by cooperating with the Institute of Sericulture, Hubei AAS. We hope that we will succeed in developing it. Our Information Institute has made certain contributions to the development of agriculture by providing information service to the users. But our information service work is still in the preliminary stages and there is a lot of work for us to do. We hope to gain some good experiences through this conference and push our information service work forward.

A New Approach to Information Systems Management at the International Potato Center (CIP): The Case of Information Services for National Potato and Sweet Potato Programs

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Abstract

This paper describes the new approach to information systems management proposed by the International Potato Center (CIP) to support: a) research and transfer functions, and b) management and administrative operations.

Focus is on CIP's Information Services that have been expanded in the recent years into an integrated system to better support national programs. A bibliographic database on the potato and sweet potato has been developed, that is based on CIP's library collection which is of particular relevance to the needs of developing countries. Information services, such as retrospective searches and selective dissemination of information (SDI), bibliographies, and photocopy services are available to national researchers and others involved in crop development.

The information services complement the production of publications authored by CIP scientists and published both at the Center and in scientific journals. CIP is specially interested in supporting the interchange of information among national scientists and has supported activities directly aimed at this goal: an Agricultural Journals Publication Procedures Database, containing approximately 200 journals where potato and sweet potato researchers publish more frequently, is available to assist those wishing to publish in national or international journals. Furthermore, assistance has been given to support the publication of the first issue of the Journal of the Latin American Potato Association (ALAP).

Further considerations for information, diffusion and exchange are projected by the International Potato Center to support national research and development worldwide.

The International Potato Center has recently developed a new approach to information systems management that includes both research and management information, analyzed from a systems perspective. This new vision of information conceptualizes "the Center as a broad information system" (CGIAR, 1989), information is seen as an input and a product of both research and management, and is an indispensable element

of the operations of the Center. CIP sees information as one of its major products, together with research and training.

CIP's information systems have two primary objectives: a) to support research and development, and b) to support management and administrative operations. These functions are viewed from an information systems perspective in Figure 1.

The underlying assumption behind this new approach is the role of information in achieving research objectives and in managing a center based on information and knowledge. The rapid pace of information technology change is a tremendous challenge that is affecting the way in which planning is done, operations are run and decisions are made.

We feel that the experiences of international agricultural institutions in information development should be shared, particularly with national systems. Particularly because the potential of information technologies application is constantly changing, an improved efficiency and output are among the expected benefits.

In viewing information as a resource that requires specific management beyond the traditional information and documentation activities, and as an essential component for overall operations, the Center has unified the resources dedicated to information processing and management. The Information Sciences Department now brings together the Communication, Information, Statistics, Computer and Public Awareness Units. The goals of the Information Sciences Department include:

- Assess information and communication needs.
- Design information and communication strategies.
- Provide the structure and mechanisms for information exchange and management within CIP and with National Agricultural Research Systems (NARS), donors, and the general public.
- Facilitate the exchange of information among national programs.

INFORMATION SERVICES FOR NATIONAL POTATO AND SWEET POTATO PROGRAMS

The International Potato Center, through its Regional Research Program and its Training Department, has established close ties with more than ninety national potato programs around the world, as well as with cooperative research networks.

In this collaborative experience, CIP has become aware that researchers, administrators, educators, and extension specialists from developing countries often have difficulty in obtaining information about potato and sweet potato research being conducted around the world. This problem is compounded by the barriers encountered by national scientists in publishing research results, thus limiting the exchange of valuable information with colleagues from other countries.



Figure 1: CIP Overall Information System

When national researchers do not have access to updated information, their research suffers. Inadequate information exchange restricts the diffusion among the world community of scientific researchers. Most importantly, it widens the gap between national agricultural research or development systems and the international centers or developed country institutions that have more facilities to access information. CIP, aware of this situation, is taking action to develop an integrated information and communication strategy that can address these issues as part of its mandate.

Several needs have oriented CIP's approach and strategies to information and communication development.

1. Information Needed to Support National Agricultural Research Systems. CIP concentrates its research on potato and sweet potato issues that are of specific interest to developing countries addressing research for which it has a comparative advantage. CIP collaborates with national programs responding to research needs and priorities, supports research and development efforts, provides needed training, research results and improved technologies. National researchers, and others involved in agricultural development also require information on the potato and sweet potato for conducting research and program development. CIP receives letters and requests daily from national programs that request updated information as an input to their research or to solve problems they are confronting in their work. Since its founding, CIP has developed a strong communications program to produce publications required for the transfer of information and in the form of training materials.

Despite these efforts and strong linkages with national programs, the needs of national potato and sweet potato researchers for updated information on latest research could not be fully addressed and, thus, computerized information systems have been developed.

2. Information to Support Former Training Participants. A major element of CIP's research and development strategy is a training effort directed at enabling national researchers to conduct research that could have a positive impact on potato and sweet potato production in their countries. In the last five years, more than 5,000 persons have participated in CIP training. The large number of persons trained have an increasing need for updated information on research available in CIP's specialized library in Lima and in larger agricultural databases.

A strong need for research information was identified in a follow-up study of approximately 500 former CIP trainees, conducted in 1984. Over 44 percent of those who responded to the survey indicated that lack of information was a limitation to conducting their research.

3. Need to Support the Exchange of Information among National Programs. The above mentioned study also revealed that national programs are conducting research and attaining results that could be of interest and of benefit to others producing potatoes under similar growing conditions. However, these results are not always published and

shared among potential users. Many do not have the skills or facilities to publish due to lack of information on publishing procedures, language and translation obstacles, the high cost of publishing, and monetary exchange barriers.

4. Need to Train National Researchers on How to Access Information. CIP'S training contacts with national potato and sweet potato researchers has revealed that most national potato and sweet potato program researchers, administrators, educators, and extension specialists have never had any formal training on how to access information from local or international sources. This limitation, together with the deficiency of agricultural information in developing countries, often leads to duplication of research, and thus to inefficient use of scarce financial resources for research.

5. Need to Supply Scientific Information to CIP Research. CIP scientists continually require updated information for their work. CIP has supported its scientific staff's information needs with library services since the formation of the Center.

ACTIVITIES AND ACCOMPLISHMENTS OF CIP'S INFORMATION AND COMMUNICATION SERVICES

Several activities described below have been undertaken to assist CIP and national program scientists worldwide in obtaining information required for their work.

CIP's Communication Activities

The mission statement of the Communications Unit states that it "supports CIP in the development and implementation of communication strategies through the generation, design, production, and delivery of communication services and products. These include publications, photography, audiovisual aids, editing/writing, translation, and communication training. By participating with CIP scientists in diagnosis of user needs, the Communications Unit helps to develop and deliver optimum quality products and services. Support is given to CIP research, administration, and training intended to assist in the exchange of research-based information between CIP's regional operations and its main headquarters as well as among national scientists, particularly through networks, professional associations and mass media."

CIP's publication program is well known among potato researchers worldwide and includes regular publications such as the *CIP Circular*, *Annual Report*, scientific documents and books, and printed and audiovisual training series.

The mailing list for sending publications includes over 6,000 individuals and institutions from around the world.

CIP's Library

CIP's Library has provided information services to CIP's scientists and trainees at headquarters since its formation in 1973. CIP is regarded by national potato programs as an important source of information on potato research. Since 1987, as CIP assumed

the mandate for sweet potato research, the library has started collecting sweet potato literature which is being included in CIP's database.

Information produced and collected by CIP is unique in that it focuses on topics of particular relevance to developing countries. The subject scope of CIP's specialized library collection covers potato and sweet potato literature from all over the world, with a good coverage of topics applicable to the torrid zone and produced by researchers from developing countries. Presently, the collection includes approximately 7,050 books, 450 journal titles, 190 annual reports, and 7,800 reprints. Included in these are unpublished research reports, and bulletins with limited circulation. Documents are found in English, Spanish, French, and Portuguese, as well as several other languages.

The collection of books, theses, and monographs is classified according to the Library of Congress classification scheme. Within this classification the section on potato and sweet potato has been expanded to accommodate a wider range of topics.

To ascertain the extent to which the literature from CIP's potato collection is referenced in other databases, in 1984 a random sample of 100 references representing the various categories of the collection was sent to AGRIS and CAB for cross-referencing. Seventy-six percent of the CIP sample was not found in the AGRIS database and 66% was not found in the CABI database. Although these are preliminary results, they indicate that many documents in CIP's library may not be found in large agricultural databases.

CIP's Information Unit

Despite a strong library collection and services, additional staff and resources were required to provide services that would respond effectively to requests from national programs. In response to this need, CIP created its Information Unit in 1985 through a joint CIP/IDRC project.

With the development of the Information Unit, CIP has been able to better assist those national programs that do not have access to updated agricultural libraries and/or have limited financial resources.

CIP's Bibliographic Database

The Information Unit has developed a database composed of information from CIP's Library collection, including non-conventional literature. The database consists of bibliographical data and keywords. While abstracting is not done, abstracts in English, Spanish, and French are included in the database if present in the original document. The database contains over 30,000 references on potato and sweet potato literature, and is updated daily with all new documents and publications received by the library.

The indexing and retrieval of information is done using keywords that have been organized into the *CIP Thesaurus* which contains over 2,000 descriptors. FAO's *AGROVOC*, the *CAB Thesaurus*, and NAL's *Agricultural/Biological Vocabulary* served

as references in developing the *CIP Thesaurus*, as well as the list of controlled vocabulary developed previously in the Library.

Access to external databases. CIP has obtained magnetic tapes of potato and sweet potato references from CABI and AGRIS and manages them on the computer at headquarters. Also, other agricultural databases can be accessed via satellite. Communication with AGRIS in Vienna and DIALOG in Palo Alto, California is also undertaken regularly. DIALOG is used for searching in major agricultural databases such as AGRICOLA, CABI, BIOSIS PREVIEWS, CRIS/USDA, and FOOD SCIENCE AND TECHNOLOGY ABSTRACTS.

Information Services

The Information Unit provides the following information services to CIP and national potato and sweet potato program researchers:

1. Retrospective searches. This service consists of the retrieval and printing of bibliographic information contained in the various databases available. Use of this service is made upon request. A Retrospective Search Form has been developed for assisting users when they request information, so as to permit a better identification of the topic of their interest. Since 1986, with the initiation of these services, the Information Unit has provided 1,260 searches for 152 users from CIP, and 329 from national agricultural systems.

Although efforts have been made to provide these services on a worldwide basis, we have found that most of the users are from Latin America due to facility of access and diffusion (Figure 2)(Cabrejos, 1989). Nevertheless, since 1989 special efforts have been underway to strengthen linkages with other continents where these services may also be required.

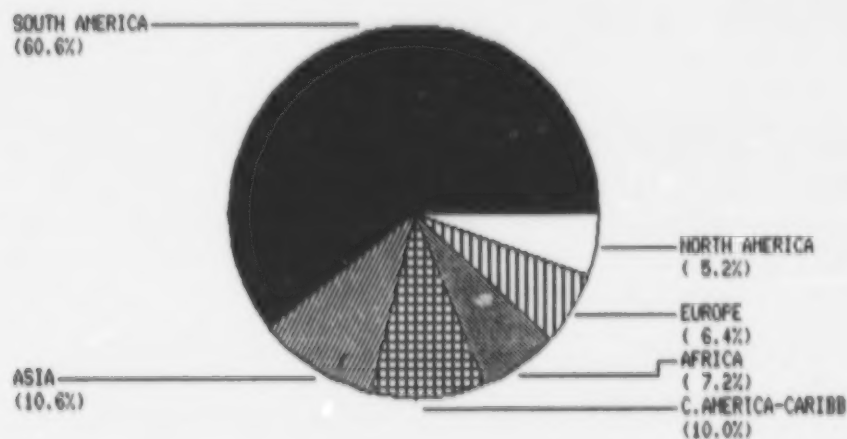


Figure 2. Geographic Origin of Users of CIP Information Services



Figure 3. Distribution of SDI profiles to CIP and national agricultural research systems (May 1986-April 1989).

2. Selective Dissemination of Information (SDI)

The SDI service was started in September 1987 and presently serves over 125 users from national programs, CIP headquarters, and regional staff. Two hundred SDI profiles have been designed to date. Figure 3 describes the distribution of SDI users.

An SDI profile form has been developed for subscribing to this service. SDI profiles are evaluated to ensure the accuracy of the information provided. These services are provided free of charge to users from national program, CIP headquarters and regional staff, as well as others such as university professors and students. An evaluation of these services is presently underway. CIP's policy of individual profiles for SDI services has contributed to the popularity of these services.

3. Specialized bibliographies. Major topic areas for bibliographies were defined based on CIP's priority research areas and on demand from external users. In the past, the library has produced specialized bibliographies in topics such as potato nematology, virology, storage, the potato tuber moth, fertilizers and others. These bibliographies have been diffused widely to trainees, libraries, national programs, and other institutions and persons requesting them.

As an output of the CIP database, at present two specialized bibliographies have been produced--*True Potato Seed* and *Integrated Pest Management of Potatoes*--and others are being planned. They are made available free of charge to national program personnel, selected libraries, and CIP headquarters and regional staff.

4. Accession lists. A monthly list of accessions is published and distributed to all CIP headquarters and regional staff, depository libraries, and national potato programs.

5. **Document delivery and referral.** CIP has the advantage of having the original documents in its library to backup the information services offered from the CIP database. Photocopies of documents are sent to persons requesting them for research purposes. Upon request, CIP offers up to two articles or thirty photocopies free of charge with each search or SDI update to national program staff. When requests for documents which are not in the library are received, the Information Unit makes efforts to obtain the documents, or the user is referred to where the document may be obtained.

Assess Information Needs and Services

Regularly, feedback is received from NARS and CIP staff through correspondence and individual evaluations of searches and SDIs. This permits a better identification of users' information needs and an evaluation of the effectiveness of the services rendered. At present, a more complete evaluation study is underway. Searches and SDI evaluation forms are regularly sent to users to obtain feedback.

ACTIVITIES TO ENCOURAGE THE EXCHANGE OF NATIONAL RESEARCH INFORMATION

CIP makes special efforts to ensure that research conducted by national programs is diffused worldwide through CIP and other databases. The following actions have been undertaken to assist in these efforts.

1. Development of a database of publishing procedures of major agricultural journals in developed and developing countries. At present, publishing procedures from all journals contained in the library have been entered, and the database contains approximately 200 references. We are now expanding the coverage of this database with journals from international and local sources. Information on procedures for publishing is provided free of charge to national researchers wishing to publish. It is expected that this activity will encourage the publication of research results and enhance the exchange of national research results and development experiences with others.

2. Supporting national or regional journals to publish issues on the potato. CIP supports selected national or regional journals so that they can publish issues on the potato. The country's existing resources are used, such as its infrastructure and publication experience, as well as communicators and editors that work in coordination with the national programs. An example of this is the support provided to initiate the *Journal of the Latin American Potato Association (ALAP)*. At present, efforts are underway to expand this type of activity in Africa where needs in this respect have been expressed.

ACTIVITIES TO DEVELOP THE ABILITIES OF NATIONAL PROGRAM SCIENTISTS TO ACCESS INFORMATION

In developing abilities of national researchers to access information from CIP as well as from other international and national information services, CIP has undertaken the following activities:

1. Trainees and visiting national researchers have been trained to use CIP information services. Training sessions on database searching are frequently conducted by the staff; this process guides users in their future inquiries for information. Furthermore, orientation of trainees on how to use the library complements this activity.
2. The Information Unit staff has participated as instructors in CIP courses to train national participants in how to access information.
3. A slide set is currently being produced, for training national researchers and extension specialists to assist in CIP's regional and in-country courses. The objective is to enable them to better access information sources available locally or internationally, including those provided by CIP.

COOPERATION WITH OTHER CGIAR CENTERS

In 1985, CIP hosted the CGIAR Documentation and Information Services Meeting that brought together representatives of the information services of all the Consultative Group for International Agricultural Research Centers (CGIAR), as well as some other International Agricultural Research Centers (IARC's). The objective of this meeting was to explore possible areas of collaboration between the centers. The meeting placed special emphasis on the responsibilities of the centers with respect to NARSs.

As a follow up to this meeting, CIP participated in the organization of the II CGIAR Documentation and Information Services Meeting held in January 1989 at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). A series of information activities have taken place as a result of the first meeting and have been documented in the report of the ICRISAT meeting. The output of the second meeting has been thirty action plans developed for inter-center collaboration of which several actions are underway.

FUTURE COLLABORATIVE CHALLENGES

Although information and communication activities at CIP are being developed into a strong integrated system, we envisage that increasing efforts are required to face the challenge of the future. As an initial concern, we are analyzing the need to decentralize information services. The use of new technologies, such as CD-ROM are also being considered for transfer and exchange of databases with developing countries. Online searching of the Lima databases via satellite is planned for the near future. The use of facsimile transmission for document delivery has been used in selected cases, and could play an important role in the coming years with increased efficiency and lower costs of communications.

In collaborative ventures with national systems, CIP is interested in exploring possible ways of strengthening information services support as well as the exchange of information among national researchers.

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Preparing English Abstracts of Chinese Documents — an Important Step Toward International Sharing of Chinese Information Resources

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Abstract

The difference of languages in various countries is one of the major barriers to international exchange of information. The Chinese pictograph system is greatly different from the alphabet of the western countries. It is difficult for western scientists and information specialists to read and to understand Chinese sciencetech documents. Therefore, publishing English abstracts of Chinese documents together with the original documents in abstract journals and their input into international information databases is an important way to introduce Chinese sciencetech documents to western scientists, information specialists and other concerned personnel, and to realize international sharing of Chinese information resources. For this reason, more personnel who can write in English and possess knowledge in a relatively wide range of disciplines and skills should be trained in abstracting in order to increase the exchange of information resources between China and the world.

I

The abstract is an outcome of the concurrent development of science and technology, information processing, and publishing in modern times. It is developing along with those three areas and has become a very important part of information services and information resources of the world. It has been a not insignificant impetus to the development of science and technology. Now there are hundreds of organizations working on abstracts; there are thousands of abstract journals; millions of abstracts are produced annually; and there is a total of hundreds of millions of abstracts in the world.

In China, only a few abstract journals in foreign languages were translated into Chinese in the 1950s and early 1960s while in the late 1970s and 1980s, Chinese abstract journals in various disciplines were published one after another, and more and more academic periodicals had their papers accompanied by English abstracts. So far, there are 200-300 periodicals which have English abstracts included with their Chinese papers. In addition, there are a few journals of English abstracts prepared from Chinese sciencetech documents, such as *Chinese Science Abstracts* and *Chinese Mechanical Engineering Abstracts*, etc. Also, some organizations have cooperated with information institutions in foreign countries in providing them with English abstracts of Chinese documents. For example, the Sciencetech Documentation and Information Centre, CAAS, has

provided CABI (Commonwealth Agricultural Bureaux International) with some English abstracts of Chinese documents every year since 1981. By January 1990, a total of 6,360 English abstracts will have been dispatched to CABI. It is not a large figure, however, it is an effective cooperation, which is significant to China, to the United Kingdom and to the world as well. As everybody knows, the difference in languages of various countries is a major barrier for the international exchange of information. The Chinese pictograph system is completely different from the alphabetic system of the western countries, which makes Chinese documents difficult to be understood by western scientists, information specialists and other concerned persons. Therefore, preparing English abstracts of Chinese documents to be published together with the original paper or in abstract journals or to be input into databases at international and national levels in the western countries is an effective and important way to accomplish international sharing of Chinese documents. We have taken a small step along this road.

II

An abstract is an abbreviated, accurate representation of a document without added interpretation or criticism. Since the target readers of the English abstracts of Chinese documents are foreigners who cannot read Chinese, the English abstracts of Chinese documents should be self-contained with major results and essential elements for the reader to understand those results. The essential elements include experimental materials, main methods, techniques, treatments and other factors or conditions which have significant effects on the results. For example, an abstract of a document on tissue culture of a plant should make it clear which part of the plant is used in the culture: endosperm, hypocotyl, cotyledon, shoot stem, leaf, etc. In another example, temperature is the most important condition for obtaining superconductivity, and the significance of the results depends on at what temperature the superconductivity is obtained.

At present, the English abstracts of Chinese documents in various publications in China vary significantly in quality. Some are very long, having 3,000-4,000 English words and covering 5-6 pages; and some are very short and simple, composed of only one sentence of a dozen English words; some have as their contents almost a translation of the full text; some are almost the same as the title of a document; some describe what prize a product or technique was awarded; some describe how the author(s) carried out an experiment, and so on. They are not standardized in both content and presentation. Consequently, their quality can not be ensured.

There are two reasons for that situation. One is that the English abstract is not well known in China. It is not known exactly what should be included in the abstract, what its correct form is and what the functions of an abstract are. Also English abstracts may be prepared by the author(s) or by others. Some of them are prepared casually with few English sentences but are considered to be correct abstracts. The other reason is that English is not the mother tongue of the Chinese, which greatly affects the presentation of contents in English. Though many Chinese scientists can read documents in English, it is difficult for them to write in English. Therefore, many of the English

abstracts of Chinese documents in various publications do not include the right contents and can not represent the real academic level of the documents.

III

As mentioned above, it is not easy for most Chinese scientists and others to prepare English abstracts of the required quality. Therefore, it is essential to train more abstractors who are able to write in English, who are skillful in abstracting and who possess a relatively wide range of knowledge so that more and more information on the results and advances of scientific research in China can be introduced to scientists, information specialists and other concerned persons in other countries and to strengthen cooperation and international exchange of scientech information.

In order to make knowledge of English abstracts and skills of abstracting popular among Chinese scientists, information specialists, editors of publications and other relevant personnel and to improve the quality of English abstracts of Chinese documents, I wrote a book entitled *Preparing English Abstracts of Chinese Documents* after I had studied a large quantity of materials and monographs on abstracting such as *ISO214-1976(E) Documentation-Abstract of Publications and Documentation* by the International Standardization Organization, *ANSI Z39.14-1971 American National Standard for Writing Abstracts* by the American National Standards Institute, *Editorial Analysis Manual* by Chemical Abstract Services, *The Art of Abstracting* by Edward T. Gremmins in the U. S. A., *Abstracting and Indexing* by Jenifer E. Rowley in the United Kingdom, materials from CABI and other abstracting organizations and dozens of academic periodicals and abstract journals both in English and in Chinese, and combined these with my experiences and problems I have encountered in providing CABI with English abstracts of Chinese agricultural documents during the past ten years. However, my knowledge is limited in English, in science and technology, in the skill of abstracting and in Chinese as well. Therefore, there are surely shortcomings in the book. Comments and criticisms are warmly welcome. Meanwhile, I would like to take this opportunity to appeal to the information institutions in all branches of science and technology and other concerned organizations in China to make an effort to train more qualified abstractors for preparing English abstracts of Chinese documents so that more and more qualified English abstracts of Chinese documents are prepared and more Chinese information resources are shared the world over.

Linking Information Resources Sharing Management and Library Training in the South Pacific

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PIC - Development with a Difference

When the Pacific Information Centre (PIC) was established in 1983 at the University of the South Pacific (USP) Library based in Suva, Fiji, it was not envisaged that the Centre would, in less than six years, be an influential unit in the development of regional information services in the natural sciences including mainly agriculture, marine studies and to some extent environmental studies. It was also not realized that the USP Library of which PIC is a part, would develop into one of the region's main centers responsible for library training. Interestingly too, over the years, PIC has come to assume the role of a regional library center responsible for many general library matters ranging from collection building and acquisition to the development and improvement of all types of libraries in the region. The work done in this regard would clearly be that of a regional library association and not one associated with a bibliographic center, the original concept of PIC.

In the past six years, PIC and its focal points--Cook Islands, Kiribati, Solomon Islands, Tonga, Tuvalu, Vanuatu, Western Samoa, American Samoa, and one regional focal point, the South Pacific Commission based in Noumea, New Caledonia (See Figure 1), have carried PIC's primary objective of identifying, collecting and recording published and unpublished materials originating in the region as well as materials about the region published outside the region and disseminating information about them. The Centre has managed and continues to coordinate and produce a number of regional publications based on its records as well as records submitted to it by its focal points. The work has proved to be realistic, difficult but workable requiring a great deal of effort, finance, training and perseverance for the center to continue with its aim of sharing information and making this accessible to all individual countries and users. Because the region's economy is agriculture based, the focus of PIC's work has been on the natural sciences, agriculture, fisheries and marine resources.

In addition, the Centre has set a number of wide ranging but specific objectives. Significant achievements have included the establishment of a South Pacific Region International Standard Book Number (ISBN) agency (November 1985), work on the Current Agriculture Research Information System (CARIS) and the International Information System for the Agricultural Sciences and Technology (AGRIS), estab-

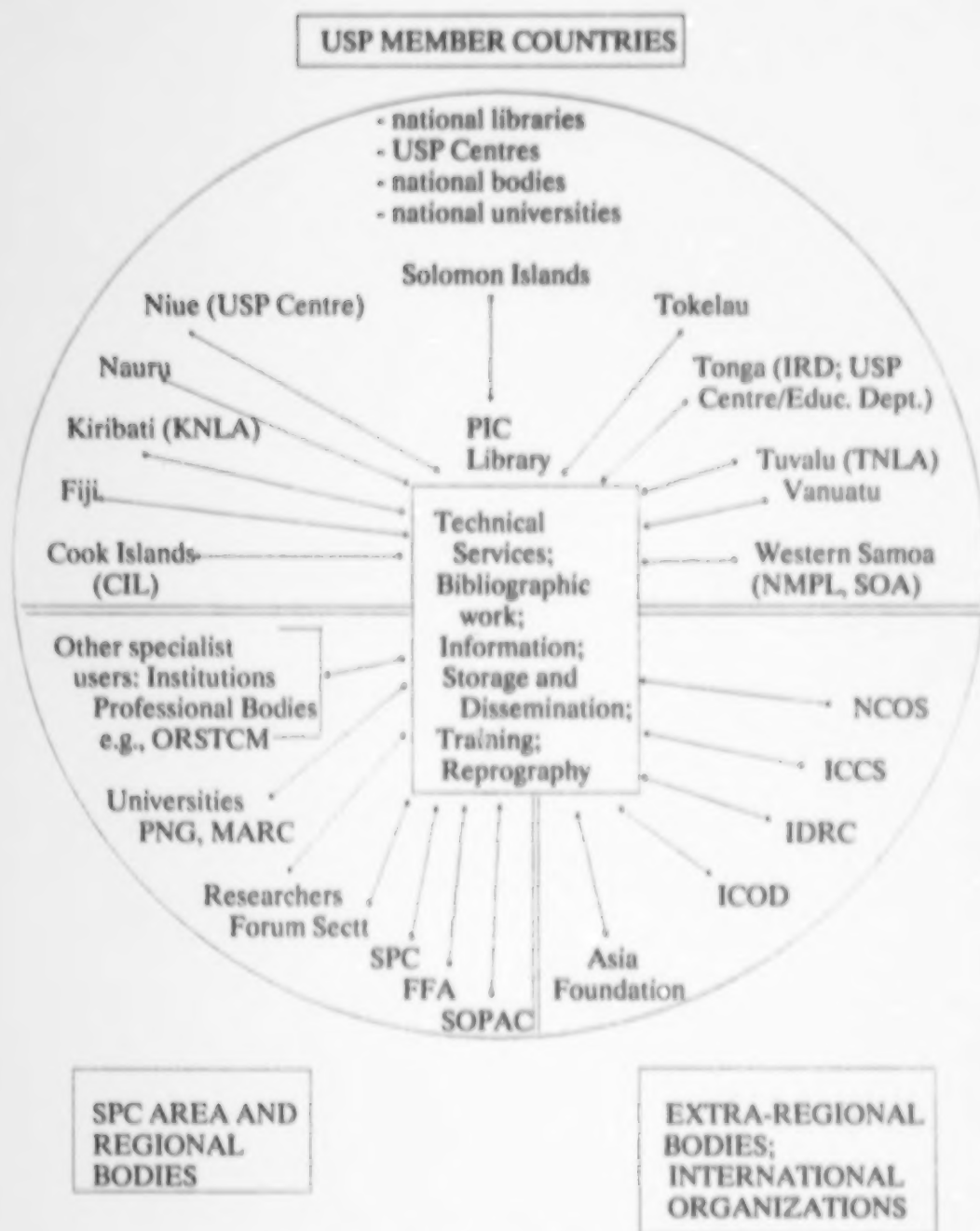


Figure 1. PIC Organisational Structure

lishment of a multi-disciplinary regional database (progressing well), and the establishment of the Pacific Islands Marine Resources Information System (PIMRIS) (August 1988). While all this work was happening it was clear that to ensure the continuity of all the activities there must be trained people. It was important to link the training of staff to the overall library and information work that was taking place not only in the Centre but in the focal points and throughout the region. To this end, the Library worked towards continued and upgraded developments in training for librarianship and information studies. This was done by introducing, managing, and teaching a Certificate Program in Librarianship (1982 and continuing) and a Diploma in Library and Information Studies (beginning with Semester 1 February, 1990). Apart from this, PIC and the USP library staff have spent many man hours offering training on site as well as advisory services in individual libraries locally and within the region.

Looking back I can say that PIC undertook more than what its objectives stated it should do. Originally a bibliographic center, PIC's responsibilities have grown many times over. At the annual PIC Advisory Committee meetings the agenda usually reflects the work of a regional library organization with national and regional responsibilities. This has been unavoidable. However, at the 1989 PIC meeting held in Nuku'alofa, Tonga, a recommendation was made to reopen talks on the establishment of the Standing Conference of Pacific Libraries (SCOPAL). In the event that this gets established, it will relieve PIC of general library work and allow it to do the more serious business set out specifically in its objectives.

The Region

The South Pacific region is made up of 22 island nations scattered over a vast area of 30 million square kilometers of which less than 2% is land. In 1988 the population of the Pacific was 5.8 million and of these 4.9 million or 85% live in Melanesia (various sources; South Pacific Commission Population 1988, census reports, Fiji, Papua New Guinea and Federated States of Micronesia). This 5.8 million represents 0.116% of the world's population which is 5 billion people. Approximately 4.2 billion people are living in the developing countries of the world in the regions of Africa, Latin America, Asia (except Japan) and the Pacific. Annual rates of growth of the populations of the Pacific vary greatly. Among the highest population growth rates in the world are the Solomon Islands growing at 3.5%, Federated States of Micronesia at 3.5%, Vanuatu 3.2%, American Samoa at 3.7%. About 75% of the population are rural dwellers most of whom live in villages. Most of the island states are in the low per capita income group ranging from Niue at US\$259.00 to Fiji at US \$1,248.00 (see Table 1). Their economies show marked disparities.

There is considerable linguistic variety in the region. Tonga, Niue, and Western Samoa have strong homogenous languages. Fiji has three major languages, English, Fijian and Hindi, but Chinese and other minor languages are also spoken. Vanuatu and the Solomon Islands have considerable linguistic variety with the added complication of pidgin and in Vanuatu, French as well as English. Apart from the variety of languages

Country	WHO	FAO	ACP/EC	Status	Land Area (Sq. Km.)	Latest Census	Total Pop. Latest Census	Adult Literacy % rate 1980	GDP Per Capita (\$US) 1983
Cook Islands	X	X		Self-governing, 10 September 1965	240	1981	17,754	91.8	1360
Fiji	X	X	X	Independent, 10 October 1970	18,272	1986	715,375	75.0	1820
Kiribati			X	Republic, 12 July 1979	690	1985	66,073	95.0	770
Nauru	X	X	X	Republic, 31 January 1968	21	1983	8,042	n/a	9091
Niue	X			Self-governing, 19 October 1974	259	1984	2,532	100	1080
Solomon Is.	X	X	X	Independent, 7 July 1978	28,530	1986	285,796	51.0	610
Tokelau				New Zealand Dependency	10	1986	1,690	97.2	560
Tonga	X	X	X	Independent Kingdom, June 1970	699	1986	94,535	99.6	740
Tuvalu			X	Independent, 1 October 1978	26	1983	8,364	98.0	570
Vanuatu		X	X	Republic, 30 July 1980	11,880	1986	140,154	n/a	700
Western Samoa	X	X	X	Independent, 1 January 1962	2,935	1981	162,200	97.8	770

Table 1. USP Countries: Key Indicators

SOURCE AND NOTES:

United Nations. Population and Vital Statistics Report, 1 July 1983.
 Pacific Islands Year Book, Sydney, Pacific Publications, 1989, 16th ed.
 Unesco Statistical Year Book, 1988.

All countries are members of SPC.

Latest census for Fiji was taken in August 1986.

Kiribati - formerly Gilbert Islands.

Tuvalu - formerly Ellice Islands

Vanuatu - formerly New Hebrides.

spoken, English is the official language for many of the countries. This suggests that bilingualism or multilingualism is common.

Table 1 gives some idea of literacy rates for a number of the countries in the region. It should be noted that figures for adult literacy are relatively high with the exception of Fiji and the Solomon Islands. But generally, the figures can be deceptive as in the case of Fiji the 1966 census considered a person to be literate if he or she had four years at school yet a survey in 1977 showed that 25% of Grade 6 pupils were unable to read simple English. In Kiribati a survey showed that 45% of the pupils at the same level were unable to read.

The status of libraries in the region and their services is a separate subject in itself, but because it is important to the context of this paper I will give a brief account. At the present time there is considerable variation in the stage of development libraries in the Pacific have reached. They extend from those relatively very poor libraries struggling to improve budgets, collections, and services and the larger libraries which receive government support but are still functioning with limited finances and trained personnel. Over the years there has been some improvement in the areas of collection building, communication, training, and cooperative programs. This has largely been the result of hard work by regional librarians and of assistance, both in money and expertise (very little) received from abroad. The developments in computerization and satellite technology have also contributed to the development of libraries and document delivery in the region. Despite these developments and the continuing changes in the social, cultural, educational, and economic conditions of the countries, governments continue to ignore the need to develop libraries of all types in the region. While educational opportunities have increased, access to information and knowledge remains poor.

It is often taken for granted that libraries are areas that will attract aid and therefore there is no planning for development in this sector. Governments fail to realize that reliance on aid and reliance on foreign expertise mean that the country will not be self-reliant in its information needs and development. There is little doubt that improving library and information services in the region will continue to be of low priority for some time.

PIC Services in Agriculture

One of the most important services provided by PIC to agricultural officers and information workers has been the contents pages awareness service. Every two months the contents pages of the latest issue of forty selected agricultural periodicals are put together and distributed to readers. There are about thirty regular recipients. Many are agriculture departments and officers. Readers are supplied free of charge a copy of any of the articles selected. The copy is sent mainly by fax if the user is outside Fiji. Otherwise, normal mail will serve the purpose. If the item is urgent then the courier service is used.

Other developments and services that are popular and used widely include:

a) current awareness service through the *Recent Additions - General and Pacific*. These are produced fortnightly and list selected new titles of interest that the library receives. About 80 to 100 titles are listed. A reader may borrow any of the titles.

b) interlibrary loans of material from the library collection and abroad. This service is made available free upon request. If the Library does not hold the item then the Library will use its interlending service to try and obtain the item from another library. This service is very heavily used. The turn-around time for requests sent to New Zealand, Australia, and the United Kingdom varies from one day if the request is made by fax to a library abroad and return by fax, or seven to fourteen days if using the normal mail.

c) information service for researchers which is supplied by the Pacific collection librarian or other Library staff. Queries are usually made by letter or telephone. The *South Pacific Research Register* is a good source of information. Most agricultural research officers are sent a form to complete and return. The register is produced every two years and lists researchers conducting research in the region.

d) the service of the agriculture liaison officers who are placed in twelve countries of the USP region and are paid under USAID. They are part of USP's Institute for Research Extension and Training in Agriculture (IRETA) and form a link in the agriculture information network in the region. They are extensively trained and meet regularly through the University's satellite system. They provide a link between the USP staff and the agriculture department staff. They keep all groups up-to-date on developments in particular areas of primary production and whenever possible collect relevant and useful publications for the Alafua library and for the Institute.

e) CARIS and AGRIS services which are at the moment being transferred to the Library/IRETA at the School of Agriculture, Alafua Western Samoa. Data collection is now complete. About 200 forms have been received. The directory should be available soon. This project has taken some time to complete due to a number of unforeseen difficulties. But moving the coordination and administration of the work to Alafua is sensible since it will closely involve agricultural people cooperating and working with PIC.

f) the use by the public of the new USP PIC database that is now being created and should be completed in mid-1990. All the Pacific collection items have been included in the database. We can only hope that this database will be useful to keen library users including those working in the Agriculture Department. In the initial stages it is planned that Agricultural Departments wishing to access the system may apply to do so once the new university ethernet system is in place.

g) short term training assignments to the USP library have been very popular and useful. In the last six years of PIC's operations there have been about four to six trainees annually. Those who come for the training learn mainly the basics of librarianship. A

number also come in for specialized training on PIC work, computerization and bibliographic work.

h) bibliographic services. Users are made aware of publications that are available in their area of work. PIC produces a number of regular publications: the *South Pacific Bibliography*, *Recent Additions - General and Pacific*, *South Pacific Research Register*, and a periodicals index relating to the South Pacific. These are distributed free to about 200 readers.

PIC and PIMRIS

The Pacific Islands Marine Resources Information System (PIMRIS) is a cooperative system involving the USP, South Pacific Commission, South Pacific Applied Geosciences Commission (SOPAC), and the Forum Fisheries Agency. It was established in August 1988 with funding from the International Center for Ocean Development (ICOD), Canada, with the specific task to serve the information needs of the government officers in the 22 countries and territories in the Pacific, and the staff of regional organizations with interest in marine research, management and training. The system's coordination center is in PIC and its major objectives are to establish a regional database for fisheries and marine resources; produce a series of publications including general and specialized bibliographies, a quarterly newsletter and information brochures; provide basic information services to include current contents (listing 49 selected periodical titles), bibliographic searches, abstracting, and document delivery; provide professional advice and training for national units in establishing and organizing collections; and provide training of staff.

With less than one year being in operation, PIMRIS has made considerable progress. There has been some groundwork done on the creation of a PIMRIS database by extracting records from the main Library multi-disciplinary database. This follows the original concept of PIC of "peeling off" certain subject fields to produce bibliographies or set up separate databases that can be transferred to the other countries in the region on diskettes. The main library system, URICA, will hold the multi-disciplinary database. The PIMRIS database will be built using CDS-ISIS, AUSMARC format and ASFIS descriptors.

There is a quarterly newsletter and a quick information service on marine science. PIMRIS offers searches on ASFA CD-ROM for any user free of charge. This service is very popular. Currently the user is helped with the search, but it is planned that this service will be available for researchers to use themselves.

Since PIMRIS has just started there are plans to introduce new services. The newsletter will change its format to include information on the fishing industry in the region, news about the markets available internationally; material and equipment information; fishing activities; fisheries people; research interests and a current contents and awareness service. Apart from this it is hoped that the need to obtain, identify, and purchase

marine science literature will be vigorous in order to build up a good marine science collection for the region.

Training Programs for Library and Information Personnel

As early as 1972 the Library, in association with the Fiji Government, commenced the Fiji Certificate Course in Librarianship. This course was conducted as a summer school. In 1980 this course terminated and the new USP Certificate Program in Librarianship commenced in 1981. This program offered through distance education is aimed at training the bulk of library and information workers that staff various libraries in the region. It targets students and workers that work under supervision in libraries. There is no special curriculum set up for agriculture library staff. The program is a general one and under the auspices of the Library, Institute of Education and Extension Services.

Since the Certificate first began in July 1981 enrollment for semester one has averaged 136 students and semester two, 115. Through 1989 over 400 students from the region have enrolled in the program. About 120 students (1989) have completed the program. Since this program is offered through distance education students self-pace their studies. Students may complete the six courses in between two to four years. Many do the courses parttime as they cannot get release time from work. Successful students are working in libraries of all types - public, academic, school, special, national.

In November 1985 at a PIC Advisory Committee Meeting interest was expressed and support received for an up-graded program in library and information studies leading to a diploma. This expressed need and demand reflects the present need for qualified, competent, semi-professional librarians in the various libraries of the South Pacific region. This has led to the need for change in the depth, standard and level of knowledge and skills that library assistants need today. Currently there is no program available in the region to meet the requirements for higher levels of information skills for library staff who provide information to policy makers, users in academic institutions, or international and regional organizations. The diploma was also a response to the need for an academically recognized and accredited program from which a student could pursue a degree program if desired.

After a series of meetings with the University the program was approved in December 1986. On 7 April, 1988, the USP and the IDRC signed an agreement in which IDRC provided support for the program. The big day commences Semester one on February 26, 1990, when the diploma will be launched on campus. It is a three semester program of one and a half years duration. The program will commence January 1991.

The project has a number of components responding to the needs expressed by librarians in the region. First there is the Diploma itself. Students are required to take ten academic courses made up of four academic subjects chosen from a select list of approved courses and six library studies courses. The library courses are: Introduction to Library/Information Studies, Building the Library/Information Centre Collections,

Organizing Library/Information Centre Resources, Library/Information Centre Services, Management of the Library Information Centre, Libraries/Information Centres - Specializations: the school library, academic, public and special. Students are encouraged to use examples from libraries they work in when writing assignments and practical work.

In 1988-1989 the library was involved in the preparation and the writing of courses. To date the library has completed almost four courses and will embark on the last two during the year. These will be piloted during the on-campus course in preparation for the distance education program commencing in 1991.

The Library has just completed screening the 44 applications received for the Diploma and has selected 33 students. These students have been selected to set vigorous criteria. It is hoped that this on-campus offering will train the much needed paraprofessionals who are already in charge of small libraries including medical, technology, agriculture, school, and public. It is envisaged that the off-campus offering will attract more students as it will be more convenient and less costly to a majority of the people in the Pacific. From January 1991 on, the program will be offered through distance education only.

The other major component in this training project is the preparation, coordination and conducting of workshops on selected topics. These are related very much to the needs of the region as expressed by librarians and information personnel. Also the selection of the Training of Trainers Workshop as the first workshop to run was important in that it trains the regional staff on how to conduct their own workshops. This workshop, run in January 1989 in Suva, has had a significant impact on those who participated.

The workshop themes include: library/information centre management and record management; automating small libraries; rural community library services; audio-visual services in libraries/information centres, assertiveness training; instructional skills for practicing librarians; recruitment and supervision of volunteers in the school library; disaster preparedness/conservation and preservation. These workshops - ten national (i.e. held in a particular country only for students and residents) and six regional (i.e. held in one country for participants from all island countries within the USP network) are integrated into the Diploma. It is also planned that nine workshop kits will be produced for use in the future. Already the outlines for all the nine workshops have been prepared by regional librarians who attended the Training of Trainers Workshop in 1989.

Teaching staff engaged in the training of the courses include one, fulltime professional librarian and one parttime. The Certificate is continuing. I assist with the teaching of one course. The training program is indeed heavy with the existing staff situation. Ideally there should be more people. Because it is a library project based within the library, it has been possible to draw on other professional staff to help. Unfortunately, in the past twelve months staff shortages due to resignation and migration has slowed down work.

This has, however, not dampened our enthusiasm and excitement over the new program as we see that our work will not only produce people who will be able to manage the many libraries in the region but also in the long term increase the pool of trained librarians which will automatically have a positive effect on the development of libraries throughout the region.

Of interest is the report of a workshop for agricultural librarians and information officers in the South Pacific held in Suva in 1984 and organized by PIC and the Commonwealth Secretariat. It was a successful conference and some of the recommendations made are included here as I feel they may have some relevance to this symposium:

a) on the program. That input from all participants is important in the construction of any workshop program.

b) on definition. That the defined roles of the librarian, information officer and the agricultural liaison officer be made clear to the officers themselves and to the appropriate ministry.

c) on subject scope. That the subject scope of agriculture is extremely broad leading to the justification for the need to promote a multi-disciplinary database for the South Pacific region.

d) on contacts. That regular contacts between farmers, information officers, liaison officers, and librarians through satellite and other communication means be encouraged and expanded to maintain information exchange on specific topics of interest as well as to discuss regional agricultural related problems and their solutions.

e) on abstracting and indexing. That this be included in future training programs. This has been done in the new library Diploma.

f) organizing and managing small library collections. That this be included in any future workshop particularly if participants are not librarians or not working in a library.

g) online databases. That a list of online databases on agriculture be updated regularly and distributed to all information officers.

h) on training. That agriculture informational officers must be encouraged to undertake training in librarianship.

The participants also identified a number of areas in the workshop that were rated highly useful and these included: information retrieval, current awareness, active cooperation, consultations and exchanges, library education awareness, the large information base available, and forms and means of disseminating information. Other areas that were considered useful included preparation of a newsletter, editing, use of the library, assessing user needs, and use of computers for small libraries.

New Horizons in Information Management and Training

What of the future? In which direction should we proceed in managing information and training? As I see it there are a number of key development issues.

Trying to Beat the Cost of Information Management

The continued success of any information center in developing countries will depend not only on financial assistance at all levels - national, regional, and international - but also on the skilled and committed staff available to do the work, and strong government backing. It is not easy for the librarian to push for preferential satellite charges, or the provision of dedicated telecommunication lines, an increased book budget, or even extra staff. Librarians will have to use their contacts with government officials to get things moving or make services so good that users will support proposals for continuation. With PIC I have found that we have been managing to continue our services because we have continued funding from IDRC and a group of dedicated and hard working staff. With our IDRC support coming to an end there will be difficulties. There is some financial support from the University but it is not enough. More intense and regular resource sharing and cooperation between libraries should alleviate the problems somewhat but only for a short time. Information management is costly and it requires a good deal of investment and creative and forceful accounting to be even marginally successful.

Working with PIC has reinforced the fact that for any new development in information services or networks in small countries in the developing world, the most sensible route to follow is to make use of and share existing structures, institutions, skilled manpower, resource sharing endeavors, physical facilities and equipment. For PIC, its smallness, and the difficulties listed above have forced it to develop the way it has, incorporating a number of activities, all separate, yet all interrelated. The load may be heavy and for a short while, particularly in the early stages, there may be some pressures to go it alone. However, with limited financial resources other alternatives do not seem practical. It is sensible to spend one's energies being concerned with building an all-embracing multi-disciplinary database with relevant and quality information. This, I believe, is a good approach for a small country which may not be able to afford developing its own system for some time. The country will depend on and share with a central unit for its information needs. Ultimately it may have to procure new technology to improve access to information it needs.

More Money than Sense

In 1985 PIC sensed that there was a great deal of proliferation in the region in the area of information improvement plans in agriculture. At one stage there were in existence (on paper and physically) about twenty different information systems related to and planned for agriculture in the region, and as usual these were all isolated. While PIC is trying to maintain frugal, sensible and relevant development in information, recently it has become more and more aware that developments and forces from outside the

region may not be too receptive to this strategy of sharing information building and networking. There continues to be some competition among international organizations with their own agendas. It would seem that this is the type of reaction we see after an international meeting on a particular area of global concern. People all want to get into the act. Experts representing international and regional organizations would come into the region and spend a day or two talking. They go away and overnight they reinvent the wheel. Everyone is busy promoting new ideas. You wonder why this is happening. Cannot the international agencies such as CABI, CTA, CGIAR, FAO, CIRAD work together for the same cause?

Since then things have not changed - the players have but the desire to start something 'new' for the developing countries has continued to be fashionable. People feel that change and development have been slow and something must be done. But change is a slow process. It does not proceed uniformly on all fronts or follow a set pattern. In the end the developing countries are again the ones that suffer in the sense that they have to put up with all these developments in the region. Be supportive if the project has government backing, spread their time thinly trying to attend different seminars and workshops usually on the same or almost the same theme (training or use of new technology for instance) but held at different locations. Furthermore, the countries often find that they are put in a corner when after three or so years of aid they are forced or expected to take on the project lock, stock and barrel. We must try to make some sense of all this.

Working with Multi-disciplinary Databases

Related to this preoccupation with new systems are the changing global development priorities. Whenever there is a change there is an interest in developing an information system in the related field. For instance, in the seventies it was energy. Agencies were supporting developments in alternative forms of energy and information systems that accompany them. Then followed agriculture, trade and investment, fisheries and marine resources, tourism, and now environment. There is no doubt that all these are important to everyday life but we must be careful that when we are approached to cooperate in any new information system we must understand and take caution that whatever work we are required to do must be within our resources and capability. Considering the rapid changes in priorities it would make sense then to develop multi-disciplinary databases. This is practical for small developing countries where the volume of publications is not so great as to overcrowd the database and enough trained personnel and financing are not available to manage the systems. Later if one wishes to specialize then one should be able to do so because in the end the basic technical practices and management and database creation are the same. Dissemination principles can apply across the board. It would be considered a waste of time, energy and resources to build major collections in the same fields but in physically different places. Also the techniques, equipment and staff costs will often be duplicated. But the pressure to specialize from the start will always be there. To resist specialization or a one subject area development will not be easy.

New Technology; Rapid Change

The effects of new technology in the region is remarkable. Only two years ago there were no fax machines. Countries were communicating using telephones, telexes, cables and ordinary mail. The fax machines are now normal office equipment. Satellite communication has been part of the University system for sometime enabling the countries of the USP region to participate in conferencing and meetings across great distances. These developments have speeded up work in information transfer and document delivery.

The number of computers has also increased throughout the region, enabling work in data transfer between countries to take place. While the full potential of the system is yet to be realized countries of the region are making use of what already exists. The information sector in the region has not tapped this facility to any reasonable degree and it is hoped that with some assistance, the use of the existing facility will revolutionize, even in a small way, information practices in the region. The use of databases on CD-ROM is already becoming a popular service to users, librarians and information people at USP, PIC and PIMRIS.

It is interesting to note that while the developing countries are adopting and moving ahead with new technology to solve the problems of distance and accessibility there are many information experts in the developed world who continue to argue that it is undesirable for developing countries to adopt these new challenges and techniques. They base their reasoning on the general knowledge that the countries of the third world do not have the manpower, finances and skills to maintain and service the equipment and use it. While both these points are valid considerations it does not, however, mean that the countries of the region must not follow this path of development. The countries in the third world cannot detach themselves from all that is happening in and out of the region because developments in the developed countries will unavoidably affect the developing countries. Librarians and libraries, if in the position to advance training and skills in the various relevant areas, should be allowed to do as they see fit. Those that hold the view that the developing countries are not ready for this change should be asked, "Then when will they be ready?" The technology is speeding by. We must decide for ourselves whether to join the race and become skilled or stand by and watch as silent partners in development.

The Value of South - South Information Exchange and Sharing

For many years USP has accessed and used information mainly from developed countries - Australia, New Zealand, the United Kingdom and the United States for study and research. Some of the services have been costly and the satisfaction rates have been varied. In recent times, with new and improved developments in database creation and networking in developing countries, a whole new world in information has opened up. Access to relevant and useful information in countries such as the Philippines, India, Africa, and even possibly The People's Republic of China will no doubt have a very positive effect on development in general in the South Pacific. The question of

relevancy and quality will continue to become important considerations. I strongly support any developments for South - South information and publications exchange as well as exchange between developing countries, North - South.

Partnership In Training

In the South Pacific as it is in many of the developing countries, education and training are key and priority development areas. Without trained people very little long term progress can be achieved. While governments in the South Pacific fund and support education, the same support is not forthcoming for training in information. Unfortunately this situation will continue into the future. It would make sense for developing countries to form a partnership in training to enable the planning, sharing and executing of training programs in information. There is much to be said for the exchange and the sharing of curriculum plans, course materials (when written), texts and teachers.

Another point that is central here is the question of the focus of the training. PIC and the USP have been involved in training at the paraprofessional level for over ten years and we are convinced that training in information must be broad, covering both the sciences and the humanities with an introduction to specialization built into the program. The students must learn the basics of information and library studies as the principles, and concepts are the same. So it would be sensible for agriculture students to undertake a broad education in library and information studies and then be given the opportunity to make a choice on the specialization option of academic, public, or special libraries. This training will prepare the student to handle and manage the growing and fast-changing accumulation of knowledge that surrounds agriculture and fisheries; knowledge that is broad and covers many subjects. This curriculum will also enable the students to manage multi-disciplinary databases. I believe that such an educational focus will provide the students with the opportunity for professional growth throughout their careers to the point where they can move on to graduate studies. It will also enable the student to function well within a rapidly changing world.

There are other useful experiences gained from this training program. One, it has enabled us to build up confidence and skills in planning, writing and teaching our own courses. Two, it has also meant that there will be the possibility of sharing written course materials with other institutions running similar types of programs. Three, we have also found that teachers and professionals from similar situations, environments and backgrounds normally perform teaching tasks better on the job than a person from the developed country with no third world experience at all. Four, for the South Pacific where the population is scattered and where many people who wish to study cannot be released from work, the distance education mode has given many people the opportunity to study. The USP has been involved in distance education since 1972, and has been very successful. And finally, linking training and library work has many advantages. Keeping up-to-date with training and changes being made in the library scene assists the practicing librarian. On the other hand the practicing librarian's experience goes a long way to making the course relevant and useful.

Conclusion

In the last ten years there has been some real progress in the development of collections in the departments of agriculture and training in the region. There has also been a growing awareness among government officers and influential people of the importance of information to agriculture and fisheries personnel, to development in general, to the economy, and to training. This justifies some optimism in anyone who is aware of what existed in the past, and who believes that it will require a miracle to get anything better than what exists now.

Despite this, some continue to see the developments in this area as being too slow and feel that there must be some changes. Surely, if progress and developments have been slower than originally hoped, that is because the job is now more difficult than originally imagined. Apart from the internal political, social, economic and cultural factors that affect progress, new developments in developed countries in the areas of computer science, technology, communications and the evolving new economic order, make catching up even more difficult. The information gap between the developed and the developing countries gets even wider. Often, developing countries tend to forget that what they are quickly trying to achieve - improved information dissemination, access and training - many of the countries in the west took a century to accomplish. Significant changes cannot happen overnight. One must be around for some time to see further positive progress take place.

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Resources of Chinese Agricultural Documents and Their International Exchange

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Abstract

About 1 million agricultural documents were produced and over 28,000 agricultural books were published in China during the past forty years. In 1988, there were 900 periodicals on agriculture and biology. In addition, a large quantity of grey documents are produced every year. Since the 1980s, guided by the policy of reform and opening up to the outside world, the Chinese agricultural documents have joined the ranks of the major international agricultural information sources and have played their proper role in the development of agriculture in the world by cooperating with the three largest agricultural databases in the world, CABI, AGRIS and AGRICOLA; by establishing relationships to exchange books and periodicals; by cooperative publishing and circulation of books with foreign publishers; and by publishing books translated into foreign languages.

China's development is based on agriculture. In its long history of development, the Chinese of various nationalities have accumulated rich experiences in agricultural production and animal husbandry. There have been many ancient great scientists such as Fan Shengzhi, Jia Sixie, Wang Zhen, Xu Guangqi, etc.; and at the same time, rich agricultural documents were left for us, such as the book *Chi Min Yao Shu* (Essential Ways for Living of the Common People) which is an agricultural encyclopedia of the 6th century, and the book *Nong Zheng Quan Shu* (Comprehensive Treatise on Agricultural Administration), etc. These agricultural documents not only belong to the Chinese people; they are also part of the precious cultural heritage of all peoples in the whole world.

Before the founding of the People's Republic, China's agriculture had stagnated and her rural areas were destitute. After the founding of new China, agriculture was rehabilitated and has been developing rapidly. During the past forty years, China has made great strides forward in all agricultural production, scientific research and education; and consequently, a large quantity of agricultural documents have been produced, totaling nearly 1 million papers as revealed by a recent survey. Beginning in the 1980s, the quantity of agricultural documents has rapidly increased, with an annual increment of 50,000 papers before 1985 and 70,000-80,000 papers after 1985. Of these, one-third are popular papers and about 10,000 are valuable academic papers. They appear mainly in books, journals, periodicals, newspapers and grey documents. The

following is the situation of publishing and production of agricultural books, journals, periodicals, newspapers and grey documents, and their international exchanges.

I. Publishing of Agricultural Books

China has published a large number of books on agriculture and biology during the past forty years. According to the *National Bibliography* and the *National New Books*, over 28,000 titles of books on agriculture and biology were published from 1949-1987, with their contents involving all fields of agriculture and biology.

1. A large quantity of materials on experiences in obtaining a bumper harvest by the farmers and on popular agricultural sciences are published by publishers at the central level and local publishing houses in various parts of the country, and receive a wide circulation. They are well accepted by the farmers due to their rich contents which are easy to understand and referred to by the farmers as "teachers without opening their mouth."

2. About 160 titles of works on agricultural history were published, among them, *Fan Sheng Chih Shu* (an agricultural book of China written by Fan Sheng Chih in the 1st century, B.C.) and *Chi Min Yao Shu* were also published in English editions which are welcome by foreign friends.

3. A complete set of agricultural teaching materials was published. In the early 1950s, China's agricultural universities, colleges and middle schools mainly copied the teaching materials of the Soviet Union which are distinct from practices of agricultural production in China. Therefore, over 200 titles of teaching materials were published one after another starting from the late 1950s. These teaching materials have been continuously revised, enriched and recomposed; and teaching materials on new disciplines are published in order to make the teaching materials reflect the current development of science and technology.

4. A number of monographs on agriculture and biology with a high academic level were published. Many important monographs were written by Chinese agricultural scientists based on the results of their scientific research and on summing up the experiences of farmers in agricultural production. In the 1960s, monographs on the cultivation of a dozen crops, and monographs such as *Infectious Diseases of Domestic Animals in China*, *Chinese Veterinary Acupuncture and Moxibustion*, *Fresh Water Fish Culture in China*, etc., were published. Since the 1980s, monographs on the cultivation of another 22 crops have been written or recomposed, such as *Rice Cultivation in China*, *Hybrid Rice Breeding and Cultivation*, *Maize Cultivation in China* and *Pomiculture in China*, etc.; and over 100 good monographs have been published on significant achievements in scientific research of agriculture and biology such as *Vegetation of China*, *Wheat Cultivars and their Pedigree in China*, *Illustrations on the Distribution of Droughts and Floods in the Recent 500 Years in China*, *Technology of Bio-gas in China*, *Principles of Tea Biochemistry* and *Techniques for Afforestation of Major Tree Species in China*, etc. At

the same time, a number of famous works on agriculture in the world translated from English, French, Japanese, Russian and Hungarian, etc., were published.

5. A large number of books on the resources of agriculture and biology in China have been published. China has rich resources of agriculture and biology. During the past forty years, large scale surveys and investigations have been conducted on natural and agricultural resources in China, and based on their results, the following books have been published: *Flora Republicae Popularis Sinicae*, *Fauna Sinica*, *Fauna of Economic Insects*, *Flora of Trees in China*, *Flora Yunnanica*, *Flora in Hubei*, as well as many other books on varieties of livestock, poultry, crops and fish, etc. Many books were also published in various provinces, autonomous regions or cities on the local animals, plants, crops, precious trees, livestock, poultry, fish, soils, climates, etc. All those publications provide us with basic data on agricultural and biological resources and are significant for their rational development and utilization.

6. Many dictionaries and reference books on agriculture and biology have been compiled and published. During the past forty years, many dictionaries, wordbooks for names of plants, animals and insects in Chinese-English, Chinese-Japanese, Chinese-Russian, Chinese-German, Chinese-French and Chinese-Latin in various disciplines in agriculture and biology have been compiled and published by compiling and translating committees affiliated with the Chinese Academy of Sciences and various publishing houses, e.g., *English-Chinese Dictionary of Agricultural Science and Technology*, *English-Chinese Veterinary Dictionary*, *Japanese-Chinese Agricultural Dictionary*, *Russian-Chinese Agricultural Dictionary*, *German-Chinese Dictionary of Agricultural Machinery*, *French-Chinese Dictionary of Forestry*, and *Dictionary of Seed-plants Names* (Latin-Chinese-English), etc. Beginning in the 1980s, some large volume reference books like *China Agricultural Yearbook* and *China Forestry Yearbook* have also been published. Meanwhile, the volumes on *Water Conservancy* (1st and 2nd parts), *Forestry* (1st and 2nd parts), *Sericulture*, *Tea*, and *Agricultural Meteorology* of the *Agricultural Encyclopedia of China* have been published, and the other volumes are to be published one after another in the near future. The *Agricultural Encyclopedia of China* consists of 25 volumes in 31 parts, which highlight knowledge on agricultural sciences in both ancient and modern times, at home and abroad.

II. Agricultural Periodicals and Newspapers

Agricultural periodicals, newspapers and biological journals closely related to agriculture are important parts of the resources of Chinese agricultural documents. They are the main forms for reporting scientific research results, exchanging information about agricultural science and technology, and popularizing agricultural knowledge. According to statistics, there have been 900 titles of periodicals and newspapers on agriculture and biology published at prefectural or higher levels since the 1980s. Among them, there are more than 70 newspapers on agriculture, farmers, agricultural science and technology and information for getting rich, and so on; 516 journals on agriculture and biology are registered at the provincial (or municipal) level, of which 130 titles are

approved for international exchange and 300 titles are internal journals for exchange at home.

Those periodicals can be classified as follows based on their compiling organization, target readers and the contents of papers.

1. Academic Journals

The academic journals are mainly compiled and published by institutions of scientific research on agriculture and biology, universities and colleges, and associations or societies at provincial or higher levels, with their main contents of reporting scientific research results, and academic activities and papers, such as *Acta Botanica Sinica*, *Acta Genetica Sinica*, *Acta Microbiologica Sinica* and *Acta Pedologica Sinica* by the Chinese Academy of Sciences; *Scientia Agricultura Sinica* and *Acta Sericologica Sinica* by the Chinese Academy of Agricultural Sciences; *Scientia Silvae Sinicae* by the Chinese Academy of Forestry Sciences; and *Acta Agronomica Sinica*, *Acta Veterinaria et Zootechnica Sinica* and *Acta Horticulturae Sinica* by the Chinese Agricultural Association; journals published by agricultural universities or colleges such as *Acta Agriculture Universitatis Pekinensis* and *Journal of Nanjing Agricultural University*; and journals published by provincial academies of agricultural sciences, such as *Soybean Science*, *Bulletin of Botanical Research*, *Entomotaxonomia* and *Bamboos Research*, etc. Those academic journals highlight the levels and trends in research in agriculture and biology in China. They are the core journals of various disciplines in agriculture and have the highest density of agricultural information. Most of them can be used for international exchange.

2. Technical Journals

The technical journals are of intermediate level compiled and published by agricultural research institutions at provincial or higher levels, carrying mainly technical papers, with some papers reporting results of some scientific research, and few theoretical papers, among these are *Shanghai Agricultural Science and Technology*, *Sichuan Agricultural Science and Technology*, *Yunnan Agricultural Science and Technology*, *Journal of Agricultural Engineering* and *Chinese Journal of Animal Science*, etc. They make up one-third of the total number of agricultural journals and are important channels for technical exchanges at home. Some of them can be used for international exchange.

3. Semi-technical Journals

The semi-technical journals are mainly compiled and published by agricultural departments in the central and local government, such as *Land Reclamation in China*, *Chinese Forestry* and *Heilongjiang Agriculture*, etc., through which the governmental departments give guidance to agricultural production and popularize agricultural techniques and experiences.

4. Popular Journals

The popular journals which have farmers as the target readers are at the primary level mainly for introducing practical techniques, operational procedures and experiences in agricultural production, such as *Digest for Farmers* (Beijing), *Knowledge on Agriculture* (Shandong), *Rural Scientific Experiment* (Jilin), *Advice to Rural Families* and *Popular Flowers*. These kinds of journals are published in every province or autonomous region, have large circulations and are well accepted by the farmers, for example, the first three mentioned above had an annual circulation of 2,030,183; 450,825; and 258,000 copies respectively in 1987, and the others all have an annual circulation of over 10,000 copies.

5. Journals of Translated Articles

There are about forty journals of translated articles compiled and published by various agricultural research and education institutions and publishing houses for reporting new theories, techniques and methods relating to agriculture in foreign countries. They report timely proceedings of important conferences and symposia, and results and technical data of scientific research in every discipline of agriculture in the world, thus removing language barriers for Chinese scientists to gain access to the agricultural situation in foreign countries. therefore, they are highly welcome by scientists.

6. Journals for Retrieval

There are 39 journals for retrieval published in 1989 including agricultural abstracts and bibliographies, which report on an annual 90,000 titles, to be used to establish a retrieval system for Chinese agricultural documents, which will be further developed into an integrated system with the three functions of data accumulation, reporting and retrieval.

III. Grey Documents

Grey documents are materials which are exchanged between organizations of agricultural scientific research, education and production, and are usually not for sale. They are mainly papers of specialized seminars, meetings on work and symposia, annual reports, research reports, proceedings, results of research, reports of surveys and investigations on the agricultural situation at home and abroad, treatises and patents, etc., and documentation on agricultural machines and products produced by various agricultural organizations. They are the primary documents which contain new and wide ranging contents, thus, drawing much attention from agricultural scientists and technicians. These materials are in large quantity with some of them later on published in journals or in books after being processed and many of them are listed as references (making up about 11% of the total references) in papers published in journals and books.

The agricultural books, periodicals, newspapers and grey documents are an unexhausted substantial treasure which provides us with rich experiences in agricultural production, records numerous agricultural and biological resources, and reports many new theories, techniques and methods, thus reflecting agricultural development and technical progress, and providing us with essential data for the future development of agriculture in China.

IV. International Exchange of Chinese Agricultural Documents

As stated above, China has rich resources of agricultural documents reflecting agricultural theories, experiences in production and results of scientific research which are significant to the development of agriculture in the world. China has a long history of exchanging agricultural documents with various countries the world over. However, implementation of the policy of reform and opening up has ushered in a new stage for the international exchange of agricultural documents in the 1980s. Now, along with rapid development, changes are taking place in science and technology with each passing day. The development of technology in communication and transportation is making the earth become smaller and the distance between countries become shorter, so that peoples of all countries are living in a world where they make contributions to each other and depend on each other for their existence. There is no state boundary for science and the resources of documents are the common wealth belonging to the peoples of the world. Today, no libraries or information centers in any one country can collect all documents in the world and promptly deliver them to their users. Therefore, international cooperation and sharing of information resources have become important developing trends.

China has been actively promoting international cooperation in the exchange of agricultural documents since the early 1980s. We started an effective program of cooperation with CABI and by the end of 1989, we had provided CABI with 6,310 English abstracts of Chinese agricultural documents which will enrich the CABI database, enhance the authority of CABI abstract journals, and introduce to the world the results of agricultural science and technology research in China. At the same time, China uses the CABI tapes for retrieval of documents which is also beneficial to the research of agricultural science and technology in China. In 1985, supported by IDRC, the AGRIS tapes were introduced into China. Meanwhile, the bibliographies of Chinese agricultural documents began to be input systematically into the AGRIS database. By the end of 1989, the input totalled 11,500 records and in 1990 the annual input will be 6,000 records. This makes a further step for Chinese agricultural documents to join the ranks of internationally circulating agricultural information and to be used by more and more agricultural specialists and scholars in various countries. We often receive letters from foreign countries seeking to acquire photocopies of original papers. In 1987, we established a cooperative exchange arrangement with the U.S. National Agricultural Library, and the AGRICOLA tapes and CD-ROM were introduced to China. So far, CABI, AGRIS and AGRICOLA, the three largest agricultural databases have been introduced to China, thus, providing the prerequisites for Chinese

agricultural scientists, technicians and teachers to search and use agricultural documents of the world.

During the past ten years, China has actively established relationships to exchange books and periodicals with international agricultural organizations, agricultural scientific research and education institutions, libraries, information centers, and governmental departments in various countries of the world in order to have a wide range of exchanges in agricultural science and technology. Now, the Chinese agricultural libraries and information centers use nearly 100 different agricultural journals and important books to exchange with more than 200 organizations in over fifty countries, thus, gradually introducing the Chinese agricultural documents to the world.

Every year China publishes about 1,300 titles of agricultural books, but very few of them are sold abroad due to language barriers and blockage of circulating channels. Since the 1980s, the Chinese publishers have made efforts to strengthen cooperation with foreign publishers in publishing, selling and circulating books so that Chinese agricultural books are now beginning to be introduced to the international book markets. Now, publishing houses have noticed that the language barrier is a major reason for difficulties in selling Chinese agricultural books and periodicals. Therefore, some foreign language editions of books have been published such as *China Agriculture Yearbook*, *Chinese Farmland and Water Conservancy*, *Advances in Current Research of Soils in China*, *The Rhododendrons in China*, *Proceedings of the Symposium on Tea-Quality-Human Health*, and *The Taigu Nuclear Male Sterile Wheat* in English; *Rice Cultivation* in French; *Hybrid Rice* in Chinese and English; and *Experiences on Fish Raising* by Fan Li (a classic) in multiple languages, etc. These publications have attracted attention from foreign publishers and agricultural circles. I am confident that the Chinese agricultural documents will surely make their own contributions to the world through international exchange of agricultural science and technology by introducing more and more Chinese agricultural documents to the international agricultural databases and publishing more books in foreign language editions.

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Developmental Status and Trends of the Retrieval Journal System for Agricultural Information in China

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Abstract

Since 1949, the year of the founding of new China, the quantity of agricultural documents produced in China totals 1 million, and increases continuously at a rate of 40,000-50,000 every year. Now a system of agricultural retrieval journals has been formed, with a total of 39 journals which amounts to 23% of all retrieval journals (168 titles) in the country and contains 110,000 records annually. For the future, the construction of agricultural databases is the core for the establishment of a Chinese information retrieval system. The processing of agricultural information will transform from manual to cybernation.

Since the founding of new China, the quantity of agricultural documents has been increasing with each passing day along with the vigorous development of agricultural scientific research, education and production. In order to meet the needs of such a developing situation, the agricultural information retrieval system, one of the major components of agricultural information services, has been established, developed continuously and perfected in practice.

I. History of Development and Present Status of Agricultural Information Retrieval Journal System in China

The retrieval journals of agricultural sciencetech documents are the main tools for searching for sciencetech documents, and an important part of the sciencetech information cause and the agricultural information retrieval system. The history of over 30 years for the development of retrieval journals of agricultural sciencetech documents since the founding of new China can be roughly divided into four major stages:

1. The Stage from 1957 to Early 1966

In 1956, the Institute for Information of Science and Technology in China was first established in the Chinese Academy of Science; thus, an organizational foundation was laid for the development of information services of science and technology in a planned way. In March 1957, a Section for Information of Science and Technology, was established when the Chinese Academy of Agricultural Sciences was founded. Since then, sections for information of agricultural science and technology were established one after another in most provincial research institutions of agricultural sciences and in some agricultural universities and colleges. This had a significant effect in promoting the formation of a retrieval system of agricultural documents in China, though there

were not many staff members in those sections at that time. In 1958, *Index of Theses in Agricultural Periodicals* was compiled and published by the joint efforts of the Information Institute of Chinese Academy of Science, the Section for Information of Science and Technology, Chinese Academy of Agricultural Sciences, and Beijing Agricultural University. In 1959, *Index of Theses in Forestry Periodicals* was compiled and published by the Chinese Institute of Science and Technology. The *Index of Theses in Periodicals* began publication in 1958 consisting of the separately published parts of *Agronomy, Horticulture, Plant Protection, Sericulture and Apiculture, Animal Husbandry, Veterinary Medicine and Aquaculture, and Agricultural Machinery*, etc. The parts of *Physiology, Physiochemistry, Botany, Microorganism, Experimental Biology, Entomology, and Soil Science*, etc., of Biological Abstracts from the Soviet Union, relating to agriculture and animal husbandry, were also translated and published.

The agricultural abstract journals in China were initiated by translating abstract journals from foreign countries. The first of its kind was *Phytopathological Abstracts* jointly compiled and published in 1960 by the Chinese Institute of Science and Technology, Beijing Agricultural University and the Institute of Plant Protection, CAAS. *Agricultural Abstracts* started to be published in 1962 by the Chongqing Branch, Chinese Institute of Science and Technology consisting of seven separate parts of *Agronomy, Horticulture, Soil Science, Economic Insects, Phytopathology, Animal Husbandry and Veterinary Medicine*, etc. By 1966, it carried over 10,000 abstracts annually and systematically covered theoretical and applied documents in the agricultural literature of foreign countries.

In September 1963, the First National Conference on the Information Work of Agricultural Science and Technology sponsored by the Ministry of Agriculture was held in Beijing. This conference has played a significant role in promoting the information work of agricultural science and technology, establishing and perfecting the institutions of agricultural science and technology, providing staff and equipment, and strengthening the information work. The *Joint Catalogue of Information of Agricultural Science and Technology in China* was compiled and published after the conference.

2. The Slackening Stage in 1967-1976

The compiling of retrieval journals in China was disrupted just when the retrieval abstract journals were vigorously developing by the great cultural revolution which lasted for 10 years, and almost all abstract journals ceased publication in the second half of 1966 until the first half of 1976, thus, the preliminarily formed retrieval system was disintegrated.

3. The Recovering and Developing Stage in 1977-1983

China entered a new stage of development in her socialist construction when the 10-year turmoil was ended, and the information work of agricultural science and technology rapidly recovered and developed. The work of organizing, compiling and publishing of retrieval journals was again strengthened after the National Conference on the Coordination of Information Retrieval Journals of Science and Technology convened in 1977. The Second National Conference on the Information Work of

Agro-Forestry Science and Technology was held in November 1977, which provided a great impetus to the rehabilitation of an agricultural information retrieval system. After the Third Plenary Session of the Eleventh Central Committee of the Communist Party of China, there was an unprecedented beneficial situation for scientific research, education and production of agriculture all over the country. In order to suit the needs of that situation, the Third National Conference on the Information Work of Agricultural Science and Technology was held in March 1980. At that conference, a "Program of Information Publications of Agricultural and Animal Science and Technology for Public Circulation in the Whole Country in 1979-1985" was drawn up, which made clear the orientation for the development of agricultural information retrieval system. The nine publications of *Agronomy*, *Plant Protection*, *Animal Husbandry*, *Veterinary Medicine*, *Agricultural Chemicals*, *Japanese Patent Abstracts (Agriculture)*, *Catalogue of Information of Science and Technology in Foreign Libraries (agriculture, forestry and aquaculture)*, *Catalogue of Chinese Information of Science and Technology (agriculture and agricultural machinery)* resumed publication one after another by the Chongqing Branch, the Chinese Institute for Information of Science and Technology, and now carry 50,000-60,000 records annually.

4. The Rapidly Developing Stage after 1984

The Fourth National Conference on the Information Work of Agricultural Science and Technology was held in November 1984. At that time, there were thirteen kinds of retrieval journals carrying an annual total of 87,000 records, thus, the backward situation of retrieval journals in agricultural science and technology was preliminarily changed and a system of integrating with various relevant disciplines was taking shape. A "Program for the Development of Agricultural Abstract Journals by 1990 in China" was drawn up at that conference. Now, the system of retrieval journals in the various disciplines of agriculture has been formed, with a total of 39 journals which amount to 23% of all retrieval journals (168 titles) in the country and carry 110,000 records annually. The forming of the system thus lays a foundation for cybernation of information retrieval in the future.

It should be pointed out that support in the form of 350,000 Canadian dollars by IDRC for the project of Agricultural Information Services in China is an action of foresight and sagacity, which has exerted a great impetus on the transformation of the Chinese agricultural information retrieval system from a traditional manual method to cybernation. In the light of the project, a national AGRIS centre has been set up with the Sciencetech Documentation and Information Centre, CAAS as the main body and seven regional AGRIS subcentres established respectively in the information institutes of the Academy of Agricultural Sciences in the provinces of Hebei, Liaoning, Hubei, Jiangsu, Sichuan, Shaanxi and Guangdong. The HP/3000-37 computer and its peripheral devices in the national centre and the PS/II-50 microcomputers in the seven regional subcentres provided by IDRC are all in good operation. Therefore, the implementation of the project has laid an organizational and material foundation for the development of an agricultural information retrieval system in China.

Construction of the database is the core for the establishment of an information retrieval system. The establishment of the database for retrieval of Chinese agricultural information has gotten onto the right track along with overcoming difficulties in computerized information processing with Chinese characters. At the Fifth National Conference on the Information Work of Agricultural Science and Technology held in 1988 in Beijing, a "Program for the Development of a Computerized Retrieval System of Information of Agricultural Science and Technology in China" was drawn up. This program made clear the orientation for the development of a Chinese agricultural information retrieval system and it was a turning point for compiling retrieval journals from traditional manual methods to cybernation. The policy for establishing the Chinese database is overall planning, dispersed processing, unified treatment, voluntary participation and mutual benefit, and combined efforts. So far a structure has been formed with the national AGRIS centre as the focus and the seven regional subcentres and other relevant organizations as the subsidiaries for database construction. By the end of 1989, there have been established a database of 40,000 records for the comprehensive bibliography of Chinese agricultural documents, a database of 2,700 Chinese agricultural abstracts, and a database of 2,100 records of awarded results of Chinese agricultural research. Starting in 1990, *Bibliographies of Chinese Documents of Science and Technology: Agricultural*, and six separate parts of *Chinese Agricultural Abstracts* are to be automatically compiled and published using the input data, and 40,000-50,000 records are to be input. The application of computers marks the beginning of a new stage in the development of an agricultural retrieval system in China.

II. Features of Chinese Agricultural Retrieval Publications

The agricultural retrieval journals in China as influenced by their disciplines and their primary documents have the following features:

1. A wide range of collection

The agricultural retrieval journals have their collected records in a wide range because there are more and more disciplines which are intersected and there is a considerable amount of agricultural documents carried in journals with or without relevance to agriculture. For example, *Chinese Agricultural Abstract-Soils and Fertilizers* in 1985 had its records collected from 238 journals all over the country, of which 21 (8.8%) are closely related to the discipline of soil; 156 (65.5%) are relevant to the various disciplines of agriculture; and 61 (25.7%) have no relation to soil science.

2. Practical contents of records

The retrieval journals compiled and published by Chinese agricultural information institutions are closely combined with the actual conditions and practices of agricultural production and modernization of agriculture in China; and much attention is paid to choosing documents from foreign countries in the light of Chinese conditions for abstracting, therefore, the abstracts of foreign documents prepared in China contain rich data which are informative and practical, and are well accepted by the agricultural scientists and technicians.

3. Unified standards for compiling, recording and indexing

All agricultural retrieval journals have their records compiled, recorded and indexed by following the standards and regulations promulgated by the state, thus it paves the way for establishing a computerized retrieval database.

4. The retrieval journals can be broken into two separate systems: one reporting documents produced in China and the other in foreign countries

In each system, there is a rational distribution of disciplines. The agricultural retrieval journals are classified into separate parts according to the various disciplines, therefore, they have a rational coverage and distribution. For example, the Chinese Agricultural Abstracts system includes separate parts of "Crop Genetics," "Horticulture," "Food and Industrial Crops," "Plant Protection," "Soils and Fertilizers," "Animal Husbandry," "Veterinary Medicine," "Aquaculture" and "Agricultural Engineering," etc., as it does for the abstract system of foreign agriculture, which mainly reports advanced technology from abroad.

5. Classified index and subject index complementing each other

At the initial stage, the Chinese agricultural retrieval journals used the classified index as the main method of retrieval. In recent years, the subject index is gradually gained as it is used extensively and its advantages are gradually better known. Now, most retrieval journals have the subject index added to the classified index which makes them more useful and easier for searching. However, searching by subject index is affected to some extent because the *Agricultural Thesaurus* has not yet been published. This disadvantage will be improved when the thesaurus is published.

6. Relatively concentrated compiling and publishing organizations

The compiling and publishing organizations for agricultural retrieval journals are comparatively concentrated, thus forming a processing and publishing centre for agricultural information with the Sciencetech Documentation and Information Centre, CAAS, as the hub complemented by the information institutes in provincial academics of agricultural science and libraries in agricultural universities and colleges. The Sciencetech Documentation and Information Centre, CAAS, compiled and published thirteen kinds of agricultural retrieval journals, which amount to 33% of the total (39 kinds) in the country.

7. National coordination of management on the compiling organization of secondary documents

A system of dispersed compiling and two-level coordinating is now practiced in publishing retrieval journals in China. The Chinese Committee for Compiling, Translating and Publishing of Sciencetech Information is responsible for coordinating the retrieval journals throughout the whole country by adhering to the principles of overall planning, assigning the work to those who are specially trained, and cooperating with joint efforts from various fields. That committee is also responsible for examining and approving new retrieval journals. The sciencetech information institutions in various ministries and commissions are responsible for coordinating the retrieval journals in their respective fields. For example, the Sciencetech Documentation and Information

Centre, CAAS, is responsible for coordinating 28 different agricultural retrieval journals. The advantages of doing so are prevention of replication and omission, ease of overall planning, and unified standards for compiling and recording, thus creating conditions for sharing of information resources, but it is easily interfered with by the authorized departments of the journals, thus the advantages are not as significant as those in the national centralized type.

III. Developmental Trend of Agricultural Information Retrieval System

1. The coordinated type of retrieval system for agricultural documents will not be changed in the near future.

Although the centralized type is theoretically desirable, it is not the right time for its practice at present. Within a period of time in the future, the retrieval system for agricultural documents has still to be constructed and perfected by in a coordinated way under national overall planning with the Sciencetech Documentation and Information Centre, CAAS, as the head and the seven regional AGRIS subcentres, information centres for forestry and aquaculture, and information centres in various specialized institutes affiliated to the Chinese Academy of Agricultural Sciences as the body of the system which should have Chinese features.

2. The construction of databases for Chinese agricultural documents is the focal point of the construction of the retrieval system. The fact that the retrieval tools now report mainly foreign documents will change gradually over time.

Until recently, it was common knowledge in China that it was difficult to search Chinese documents but it was easier to search foreign documents because most Chinese retrieval journals were started by translating the foreign ones and they mainly cover foreign documents. This results in needing more investment but serving fewer users, low utilization rate and efficiency, as well as insufficient investment in Chinese retrieval tools which could play a better role, therefore, there is a structural defect in the investment. In order to bring the system into full play, it is essential to adjust the investment so as to expand and perfect the Chinese retrieval system to make it reliable and authoritative to the Chinese agricultural scientists and technicians. It will be the main trend for the development of a retrieval system for Chinese agricultural documents.

3. The quality of retrieval publications will be continuously improved, and database construction, compiling and publishing will be integrated.

The Seventh Session of the Chinese Committee for Compiling, Translating and Publishing of Sciencetech Information has adopted a document "Scheme for Establishing and Perfecting Retrieval Publication System of Sciencetech Documents in China" which sets the three points of high searching rate, convenience and promptness as the requirements for the retrieval journals in view of the present situation that in that there are some problems in quality in most retrieval journals. The searching rate, convenience and promptness will be improved along with the establishment and perfecting

of computerized retrieval system for Chinese agricultural documents. The printing quality of retrieval journals will also be further improved and the time difference will be reduced since the retrieval journals and their index are cybernetically compiled and printed using the same input data.

4. Processing of agricultural information will transform from manual to cybernation.

It is pointed out abroad that information science has three major fronts: automatic indexing, automatic compiling of abstracts and automatic translation. The first two are in the category of information retrieval and have been rapidly developed.

The cybernated indexing in China during the past few years can be divided roughly into two types: computer-aided and automatic indexing. The research on computer-aided indexing was started in 1980. Although it is comparatively late, some progress has been made. The key for realizing computer-aided and automatic indexing is the construction of a computer readable vocabulary, dictionary and thesaurus. Now, the agricultural thesaurus in China is managed by computer, which provides a basis for computer-aided and automatic indexing of agricultural documents. It is expected that the computerized edition of *Chinese Agricultural Thesaurus* will be published soon and computer-aided indexing will be realized in which the standardized descriptors will be automatically produced. The automatic indexing will be gradually realized on the basis of computer-aided indexing. So far, no research has been done on the computerized compiling of abstracts.

5. Microcomputer and CD-ROM techniques will promote the further development of agricultural information retrieval systems in China.

Information processing and transmission have been common to thousands of families due to the development of the microcomputer, its renewal and the development of communication techniques whereas magnetic tapes remain to be an essential medium for storing large quantities of data, which can not be popularized because of price and conditions for their application. The development of CD-ROM may settle the problem of information storage. Recently the CD-WORM for both reading and writing has already been put on market. Many specialists predict that CD-ROM and CD-WORM may be the most promising carriers of information. They may cause great changes in the information services of database retrieval systems.

6. The agricultural information retrieval system in China is not limited to a database of documents but also includes more and more numerical and factual databases.

The "Database of Transaction Information on the Results of Science and Technology in China" established by the Beijing Municipal Institute of Science and Technology has collected 23,000 updated technical results from 2,600 organizations all over the country. The "Database of the Results of Science and Technology in Agriculture, Animal Husbandry and Fishery" established in 1988 by the Sciencetech Documentation and Information Centre, CAAS, had 2,100 records by the end of 1989. It has opened up a promising way for establishing a database of agricultural facts. There have been 280

databases established in China. Among them, the number and rate of use of non-document databases are higher than that of documents. It is predicted that the agricultural information retrieval services with their information resource databases established based on computerized systems will take on a new look in the information society.

In short, the Chinese agricultural information retrieval system has grown out of nothing. It has a not insignificant impact on the development of agricultural scientific research, education and production in China. Although the Chinese agricultural information retrieval system was formed relatively late, it is developing rapidly. Presumably, there could be a number of breakthrough results in the next decade, which would be practically applied. However, we should be aware that there are still many difficulties facing us and there is still an arduous way ahead.

Exploitation and Utilization of Sericultural Information Resources in China

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China, the home of silk, has been a leader in cocoon and silk production since ancient times, and its silk output is a thumb across the world. Silk cloth is also a traditional export of the country. Recently, silk and silk cloth exports have amounted to 90% and more than 40% of the world's total respectively. The largest silk research, education and production system in the world has been set up in our country. At present, it has been widely shared with other countries of silk production and trade to stimulate the development of sericulture throughout the world.

Silk production and the spreading of scientific and technological achievements push forward the development of silk scientific and technological documents. Special sericultural documents handed over to us from past dynasties number at least 50 titles, so both ancient and current documents with sericultural contents can reach 100 titles. In modern times, especially after the founding of our republic, periodicals at the national and local levels have reached more than 30 kinds which are edited by related units. Scientific and technological researchers have written a large amount of scientific and technological theses and have edited and published lots of works by means of reporting on scientific and technological achievements, summing up production experiences, importing new scientific and technological achievements and technical materials, and developing academic exchanges both within the country and abroad, so sericultural documents get richer and richer in the country. The great amount of sericultural scientific and technological information is being transmitted to production, research and education departments through different kinds of media to accelerate the development of sericultural production. When new China was founded in 1949, the output of cocoons was only 30,900 tons. In 1970 and 1977, the output of cocoons and that of silk both respectively sprung to first place across the globe. In 1988, the output of cocoons was up to 394,000 tons, and sericultural production covered more than 1,200 counties in 26 provinces (regions) and cities. Presently, the task which stands in front of us is how to dig out these precious and plentiful document resources to serve sericultural production in our country and other developing countries to meet the needs of international silk trade and to make people's lives more colorful around the world. With the above purpose, we have already indulged ourselves in preparing and constructing a world sericultural document database as quickly as possible. Furthermore, a series of tasks have been accomplished and several main aspects are described as follows:

1. Continuously strengthen the information document foundation and widely develop the collecting and processing of sericultural scientific and technological documents.

As the center of sericultural research and scientific and technological information, the institute has continuously collected and processed sericultural information documents since the 1950s when it was founded. Material exchange relationships and information networks have been set up among more than 200 units of research, education, production and library and information centers in 27 provinces and cities. Nowadays, nearly 100 titles of foreign documents, more than 300 volumes of internal professional documents as well as more than 200 types of meeting materials have been collected by various means. The library with more than 60,000 volumes of books is being replenished and enlarged, so it is getting more and more comprehensive, especially in the respect of professional documents.

All the internal collected documents must be processed and classified in a timely manner so as to be conveniently available to researchers. External materials should be promptly translated, then special subject materials should be edited, published and issued to serve as references for the numerous scientific and technological researchers in research, education and production management.

2. Editing and publishing sericultural scientific and technological books and periodicals in favor of accumulating and propagating sericultural scientific and technological documents.

Since the 1950s, in order to meet the needs of the development for sericultural production and science and technology, the institute has edited and produced 6 titles of sericultural scientific and technological periodicals. Among them, three periodicals are at the national level, which are the academic periodical *Acta Sericologica Sinica* the indexing periodical *Abstracts of Sericulture*, and the translated and reporting periodical *External Agronomy -- Sericulture*. These periodicals have become the main tools which reflect sericultural scientific research achievements and levels in the country, spread advanced techniques and experiences internally and externally and index documents for both at home and abroad. The above periodicals have been welcome and praised by sericultural researchers around the world. At the same time, numerous sericultural scientific and technological researchers have been called together to selectively translate academic works and handbooks. Up to now dozens of external sericultural scientific and technological materials on special subjects have been edited and translated. This has pushed professional document accumulation, advanced the spread of new achievements and techniques, and stimulated the development of sericultural science and technology and production greatly.

3. To prepare for building document database.

First, a sericultural thesaurus will be edited to create favorable conditions in the indexing of documents.

The Sericultural Research Institute joined with other institutes of scientific and technological information and other related units in China to design and create a *Chinese Thesaurus* during 1975-1978. Sericultural scientific and technological phrases and terms were gathered and edited, optimally chosen and standardized, and this became an integral part of the *Chinese Thesaurus*. On this basis, the provisional manuscript of a *Sericultural Thesaurus* had been compiled to lay a foundation for indexing.

Subsequently, a large number of sericultural scientific and technological researchers were gathered to take part in the processing of documents by editing abstract periodicals.

Abstracts of Sericulture is one of the sericultural indexing periodicals that are published by the national general plan in China, and it is an important result of our work. Sericultural science has many branches so its documents are plentiful. Annually thousands of reports on sericultural science and technology appear in hundreds of media forms such as books, magazines, research reports, meeting records, special periodicals and bulletins, etc. *Abstracts of Sericulture* meets the needs of numerous scientific and technological members by collecting and processing these documents and technological information. At the same time it is also part of our preparation to build up a computer document database as planned. In the past ten years, we have been able to do a lot of work on processing documents under adverse circumstances of reduced strength, shorter time frames and poorer conditions, because many sericultural scientific and technological members feel compelled to expend their energy to compile document abstracts by combining them with editing and publishing abstract periodicals. Meanwhile, the main manual document indexing warehouse which stores both domestic and foreign documents from 1980 to 1989 has been established by taking advantage of the good conditions for publishing abstract periodicals, and sorting documents by document contents, resources of original documents (documents name) and countries of publication of the documents. Up to now, more than 7,000 volumes of documents abstracts have been stored, and a system of information document indexing has been set up to form the basis for building up the warehouse.

4. Widely develop cooperative research to lay the foundation for making indexing tools more perfect and to serve users effectively.

Under the new conditions of rapid scientific development and dramatic rising amount of documents, the main wishes of a vast number of scientific and technological researchers are to get required information thoroughly and accurately in a short time.

For this reason, we have started to edit and publish *Bibliography of Classification Index of World's Sericultural Documents*, which is presided over by the Sericultural Institute, CAAS, in cooperation with the following units: Guangdong Academy of Agricultural Sciences; Suzhou Sericultural Training School; Sericultural Department, Zhejiang Agricultural University; The Sericultural Institute in Zhejiang Agricultural Academy of Sciences, etc. The contents are divided into two parts: internal documents and external ones.

First of all, the title catalogue is made from sericultural professional scientific and technological documents in China in the 1980s, and a *Catalogue of Sericultural Scientific and Technological Materials in China* has been drawn up. At present, 13 volumes (containing more than 1,000 entries) have been edited and published to serve the related sericultural units throughout the country. The catalogue can be used as a measure to help scientific researchers indexing modern documents manually, also, it can be regarded as an indexing tool to aid in the work of document processing in the future. Next, in order to provide services of information retrieval in sericultural circles and to lay a foundation for building up a computer information retrieval system, it is necessary for us to edit annual volumes of title catalogues from the 1930s to the 1960s. (In the 1930s cocoon output reached its maximum in our country.)

Second, the collection of external documents comes from the chief silkworm and cocoon production countries which include countries in Asia, Europe and America from 1950 to 1985. At present, document collecting is almost finished. A Japanese document title catalogue of about 30,000 entries has been collected, and more than 15,000 entries on cards have been translated. Meanwhile, for the Europe and America document title catalogue more than 6,900 entries have been included, and in 1987, they were edited and published in the form of initial articles, and issued to the related sericultural units scattered across the country. Furthermore, it will come out in a Chinese-English bilingual edition to serve sericultural scientific and technological researchers in document searching throughout the world.

The completion of the programme will provide an integral sericultural scientific document searching tool to society, although its speed is slower than that of computers, it is based on scientific data. It is suitable to give advice to consumers in different geographical areas and to meet the particular needs of individuals. At the same time, the information provided by the programme holds a far-reaching value because not only does it become a useful retrieval tool in different research fields, but also gives a service to sericultural researchers in all production countries, especially developing ones.

Experience has shown us that *Bibliography of Sericultural Scientific and Technological Materials in China* has had a great effect in the editing of the book *Sericulture in China* and the classification index for volumes 1 to 50 of *The Journal of Sericultural Science of Japan* is being warmly welcomed by numerous scientific and technological researchers. Researchers reflect that not only does it provide reference for sericultural scientific research design, but helps to avoid unnecessary repetition. They agree that scholars

make a great contribution to serving vast numbers of sericultural workers. The index positively shows us our goal to meet the needs of consumers, thus we can create works of great value to our society.

5. To set up a national scientific and technological information network on sericulture to systemize countries sericultural scientific and technological information documents.

In order to let information better serve science and technology, production and education, as well as decision-making, overcoming key problems and selecting projects, it is imperative to gradually break through the situation where some professional departments always work independently, strengthen continuously the lateral relationships to give play to the superiority of cooperation, and initiate the new goal for professional information entirety and systemization. That is: to form the country's cooperative network and to establish an information system by paying attention to the whole to effectively serve the development of sericultural information services, research and production. Not only can it serve current needs, it can push information science forward, and clear the way to higher quality and efficiency.

To further this purpose, we have prepared to construct our country's sericultural scientific and technological information network. Its main task can be described as follows: We can grasp China's trends in the development of sericultural research and production by information exchange among member units. At the same time, we must summarize our progressive experiences and be aware of existing problems, then organize the relative scientific and technological information to be aimed at serving the needs of the related department so as to push forward the professional development of science and technology as well as production. Meanwhile, with the purpose of providing comprehensive information service, it is very important for us to give full play to cooperation and to jointly finish projects of information investigation and research in order to solve the problems which can not be settled by a single department.

The Agricultural Information Users in China and Changes in their Requirements

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Abstract

This paper introduces characteristics of agricultural information users in China, changes in their requirements and supply, and patterns of information services. In recent years, the great changes in contents and delivery patterns, the expansion of users' levels and the improvement in information transmission make China a vast agricultural information market. It is suggested that survey, analysis, and training of users, improvement of information services and communication media for timely and effective information transmission are common tasks for librarians and information specialists and should take the lead in user services today.

China is a large market for agricultural information. She has a population of 1.1 billion, of which over 80% are in rural areas. In 1988, the cultivated land per capita was 0.1 ha. In the areas with dense population, the cultivated land per capita decreases to 0.05 ha. The average grain production per capita in the same year was 359.5 kg. In this situation, the essential way out for agriculture is to improve agricultural productivity, increase the unit yield of crops and get efficient use of resources. To rely closely on advances in science and technology, the extension of practical techniques and information transmission have also been becoming important factors in the development of agriculture.

Through the reform of economic structure and economic systems in agriculture, technical information needs in rural areas are becoming more demanding than ever. The structure of agricultural users and their information needs have been changing greatly in recent years. User research has not only current significance to deal with present contradictions of information transfer, but also an inevitable role in adjusting and completing the national information system and improving the information services of the country.

A. Real Information Users and Characteristics of Their Information Needs

At present, there are 3,888 departments of science and technology information in China. In agricultural fields, over 10,000 library and information staff are working at different levels such as agricultural information institutes or information divisions from thirty provinces or library and information units at universities and colleges. However,

because of the multiple levels of information users and various user needs, the satisfaction rate of users is still very low. The real information users normally include:

1. Agricultural Researchers

In China, there are almost 95,000 people engaged in experimental research in various fields of agriculture at different agricultural institutions. They are becoming the most powerful contingent in the development of agricultural science and technology in China. The information needs for them are mainly information about development trends, advances and methods in agriculture and agricultural related research from invaluable bibliographies, abstracts, achievement reports, proceedings, etc.

2. Faculty Staff and Students

There are 26,000 faculty staff in agricultural universities and colleges. Among those, 1,031 are professors, 4,724 are associate professors, 8,731 are lecturers, and 11,004 are assistant lecturers. Their information needs are mainly concerned with how to improve their teaching quality, including supplements and renewal of course materials and reform of teaching methods and aids, etc. For some senior and medium level faculty members who are undertaking research projects at the same time, they also need information of advanced developments in science and technology. The faculty's information needs directly influence knowledge renewal for themselves, teaching quality and the education of new generations. This is essential for increasing our scientech agricultural contingent and for realizing modernization in agriculture in China.

The number of agricultural students has reached 240,000 in 67 universities and colleges. Graduates are up to 30,000 each year, of whom there are 5,000 postgraduate students. All of these students have more or less learned about information sciences in school and they are not only active users at universities and colleges, but also important users in institutes after their graduation.

3. Extension Personnel

China has about 650,000 agricultural extension personnel who play a backbone role in the forefront of agricultural and forest production. They badly need information about practical techniques and the newest achievements as well as experiences in increasing grain yield.

4. Administrative Members

Managers in agriculture number almost 650,000 in China. Some of them directly instruct agricultural production, scientific research or teaching; some of them are responsible for decision making and organizing and implementing plans. These administrative staff need information of agricultural trends and development, particularly macro, strategic and general information in agriculture, which is a valuable reference source for them in decision making and management.

B. Potential Users

Potential users here means students who are preparing to enter agricultural universities and colleges; working people from newly created village factories; agricultural personnel and a wide range of farmers with special techniques and so on. The amount of the potential users is much larger than the real users in agriculture in China. It is particularly significant for librarians and information specialists to know the needs of these potential users, and do some research as well as predict their development in the future.

1. Students Being Admitted to Universities and Colleges

There are over 30,000 students who are admitted to agricultural universities and colleges each year. It is a main source of agricultural information users who will use agricultural collections in various institutions in our country.

2. Agricultural Personnel

These are normally local agricultural specialists in various fields; or farmers with some special skills who are trained through broadcast agricultural courses and short term training classes. They have formed a large extension and display team for agricultural techniques. The top technicians of the team have already reached 2,000,000. Along with an increase in their knowledge levels, their information needs will increase at the same time. They are a huge group of potential users full of vigor and desire to use agricultural information.

3. Farmers in Village Factories

In recent years, factories in rural areas have been setting up quickly. Now there are 17,000,000 village factories in China. The village factories are one of the important components of our newly formed economic system in rural areas. They have the right of self control for their business and are eager to get information to help them compete with others. At present, village factories maintain over 80,000,000 farmers who become a vast potential river of agricultural information users.

4. Agricultural Specialists and Large Business Families

Following the reform in rural areas, agricultural specialists and large business families have been merged constantly, and gradually have entered the stage of union/business systems. These users greatly need information on practical techniques for becoming wealthy. These potential users are scattered everywhere in the rural areas in China.

C. Trends of Agricultural Information Transfer and Needs

Changes in agricultural information needs make the contradiction between information suppliers and users become more and more serious. The traditional library functions of reading and lending have been transforming into a type which offers information. The potential value of information can only be identified by the use that is made of it. However, to access needed information within the current scientech literature sea is an extremely time-consuming and exhausting job. According to a survey by the Chinese Theoretical and Methodological Group of Scientech Information, 80%

of users complained that it was hard or very hard to find key information for their research; 14% of the users could get their needed information without difficulty and 3% of the users could not get the information they

wanted. Information needs exist everywhere in the country, however, a large amount of user needs still can not be satisfied. To help users find their needed information in relatively short time, by simple methods, and at low cost are common tasks facing librarians and information specialists today.

1. Multi-interest Information Needs from Users

In an information society, changes in economic structure, social structure and social life cause great changes in information sciences. The situation of user needs for scientific information in the past has changed into multi-interest information needs including: economic and technical information, marketing information, management information which contains advanced productive techniques, experiences in business and various information for each period of production, postharvesting and sales, etc. Farmers need information concerning product sales; agricultural specialists need information on how to plant and breed, market prices, good varieties, etc.; village factories, which are trying to attain higher efficiency and develop to compete in society, want to frequently receive information about new technology, new materials and sources, and new products as well as the development of related companies in the same field and other marketing information.

2. Information Needs are Becoming of Primary Importance in the Information Society

Particularly in Chinese rural areas, users are aware of the significant role of information in increasing grain yield and their income. They actively collect related information for their own use. Agricultural personnel become their on-site reference instructors. A lot of users come to them to make queries. However, because of the shortage of agricultural personnel in rural areas, users still badly need technical information which is proper for local practice, simple to learn, and easy to put in use. Library and information units should consider their eagerness for information and collect and process information and documents which would be welcomed by these users as effective services.

3. Information Needs are Becoming Efficient

Following the development of the information society, people are paying more and more attention to timeliness, efficiency, and value. Information represents potential productivity which promotes the development of the economy of the society. The aim of users in looking for information is to enhance the economic efficiency and productive and competitive ability of their products. So, beneficial information is particularly welcome by users and they even want to spend more money to buy such information. Paying for information is getting more and more acceptable in today's society. This is a beginning for information becoming a commodity. In this way, the agricultural information centers will be able to add new services which would efficiently select timely, highly valuable information and sell it at a reasonable price.

4. Information Users are Becoming Widely Scattered

In recent years, the amount of Chinese information has been increasing yearly. This is because the range of users has expanded from scientists, managers, teachers and students to farmers in remote and mountain areas, planters and village technicians, etc. Although there have been several kinds of user services such as newspapers, journals, library loans, bibliographies and indexes, bookmobiles, and SDI services, it still can hardly meet actual user needs because of inconvenient communication and transportation facilities and fewer information specialists in the rural areas.

When information centers consider user needs, we must consider the above mentioned changes, and to take into account actual user needs, when deciding on appropriate services and strategies to offer the right information in a timely and accurate manner for good cooperation between information specialists and users. There would be no reason for the existence of the information system itself if it loses its users. However, in the information society today, new trends and changes in information needs have brought about higher requirements and new challenges to librarians and information specialists for more effective information services at different levels.

D. Current Agricultural Information Transmitting Methods

Compared with advanced countries, China, at present, has rather insufficient communication media for information transmission. The main current methods to access information are still by some traditional ways.

1. Serials.

Serial publications such as bulletins, translated journals, quick news, abstracts, bibliographies, books, etc., transmit a great amount of information to users. Now there are more than 700 journal titles published in agriculture and agricultural related areas in China. These journals disseminate over

100,000 entries of agricultural information each year to form an essential tunnel for agricultural information transfer.

2. Offering Direct User Services by Using Library Collections

In order to let users know about new library collections in time to choose needed information, library and information centers at different levels offer various user services such as SDI, information tracing services, distributing regular subject bibliographies, and library new acquisitions bulletins, etc. SDIC, CAAS announces over 60,000 new titles in its collections to users throughout the country each year. More than 20,000 library users come to the library to borrow books, about 32,000 use the library for reading and scanning services, and library loan reaches over 30,000 items each year.

3. Organizing Information Exchange Activities Using the "User-Producer-Seller" Model

Information exchange activities among users, producers and sellers such as various product shows, agricultural techniques fairs, scientech information fairs, and so on are

useful ways to help users to get wanted information. Such exchanges have not only printed materials but also real products which are easy for users to examine to decide if it is applicable for certain practices. To organize book fairs for selling and exchanging books and other publications is another practical method for information exchange which is welcome by our users. Outside library services have widened the range of library user services, and helped the library to develop and utilize library collections. This shows the multiple functions of library and information services in the country.

4. Agricultural News Releases

For disseminating new agricultural technologies directly to farmers, SDIC, CAAS held a news release meeting, Sept 22-28, 1988, in Liuhe county, Jiangsu province.

A total of over 3,300 new agricultural research achievements such as new improved varieties, feedstuff formulas, sample products, new medicine and micro-compound fertilizers, etc., were shown to 540 participants from 27 provinces (regions or cities) including agricultural engineers, managers, technicians, and extension workers as well as farmers. Almost 150 practical agricultural video films were supplied at the meeting. Many new techniques and methods were accepted at once by participants, and 400,000 yuan of contracts were made during the meeting.

5. Computerized Information Retrieval

Computerized information retrieval is one of the main techniques in modernized information services. China has now begun to step into the era of computerized information retrieval. Magnetic tapes of the international agricultural databases of AGRIS, CABI and AGRICOLA have been loaded on our mini and microcomputers for current and retrospective information retrieval. The National AGRIS Centre and subcentres coordinate closely with each other and have formed a national agricultural information network under centralized planning. The Chinese language database of agricultural documentation has accumulated more than 40,000 bibliographic records and started its experimental searching for users. Online agricultural information search services in Beijing have also begun to offer access to those who have microcomputers.

6. Audio-visuals, Radio Broadcast and TV Services

These kinds of services are particularly welcome by users in rural areas. By using easily understandable language and acceptable forms, radio and TV rapidly promote new techniques and new products to audiences in order to improve the development of agricultural production, the extension of new technology and better methods for more benefits. Within recent years, the affiliated departments of the Ministry of Agriculture have produced hundreds of video films on agricultural applications of science and technology which have been shown on TV to the whole country. This service is directly serving the development of agricultural production in China.

E. User Training and Development

The degree of development and use of information resources directly influences the scientific advancement and development of the social economy. However, whether or

not the information resources can be ultimately developed and utilized relates closely with the capability of the users. User information needs are normally decided by their own information sense and knowledge levels. The training and development of users become important factors in enhancing user information quality and serious matters to which we should pay more attention.

For different users, library and information centres should adopt different training methods. Current users need directions on how to effectively use the library collections and to search for needed information by formal training courses; potential users need to learn some general things about library and information science to let them enter the door to the library collection. Through training, users may understand the role of information for themselves, enhance their interest in using library collections, get acquainted with information resources and basic methods of using the information searching tools. User training plays a decisive role in the ultimate use of information resources.

The development of information users is an essential task for library and information centers. First of all, we should know our current user situation and be able to predict their future information needs. Second, according to users' professions, knowledge levels, research topics, etc., we must do some investigations concerning their use of documents, and then, offer proper training for those users to constantly expand our user base as well as their interest and ability in using information resources in order to bring the social and economic benefits of information resources into full play.

China has tremendous and far reaching potential in agricultural information services. There are more and more users who are getting to know the significant value of information to them. It will be a common challenge facing librarians and information specialists to offer information services at various levels, by various methods and for more benefits so as to promote the development of agricultural science and technology in China.

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BIOSIS as an Agricultural Information Resource

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Introduction

BIOSIS^R is the world's largest abstracting and indexing service for biological and biomedical research. A not-for-profit organization, BIOSIS was founded in 1926 to provide comprehensive research information to scientists, educational and research institutions, corporations, and government agencies. Over 9,000 serial sources from all over the world are monitored for information on the life sciences for inclusion in the BIOSIS database. The subject coverage of the database includes traditional areas of biology, such as botany, entomology, and zoology, as well as related fields, including agriculture, pharmacology, and ecology. This paper will focus on BIOSIS' coverage of agriculture and agriculture-related areas.

In order to better serve the needs of its users, BIOSIS produces a wide variety of products. Further, many of these products are available in several forms, both printed and electronic. The two main printed publications are *Biological Abstracts*^R (*BA*) and *Biological Abstracts/RRM*^R (*Reports, Reviews, Meetings*) (*BA/RRM*). *BA* provides abstracts, in English, of English and foreign-language original research articles. The abstracts are grouped under broad subject headings and full bibliographic data is included. *BA/RRM* contains citations, in English, of research reports, review articles, and books. *BA/RRM* is also one of the few indexing services that provides coverage of papers and abstracts published in proceedings of international meetings.

BA and *BA/RRM* are also available in a computer-readable form, called *BIOSIS Previews*^R, through online vendors. This online database comprises the bibliographic data contained in *BA* and *BA/RRM* along with additional indexing information. A new CD-ROM version of *BA*, *Biological Abstracts on Compact Disc (BA on CD)* was introduced in the beginning of 1990. The compact disc format permits particularly powerful search and retrieval capabilities.

Another online BIOSIS product is the *Biobusiness*^R database. *Biobusiness* specializes in providing information on the economic implications and business applications of biological and biomedical research. Some of the main subject areas covered are biotechnology, cosmetics, pharmaceuticals, agriculture/animal husbandry, forestry, and foods and beverages. *Biobusiness* was designed to meet the needs of corporate researchers and executives and contains abstracts and citations of a wide variety of literature sources such as journals, research reports, and U.S. patents. *Biobusiness* is only available online; there is no equivalent printed publication.

Indexing

Access to the records contained in these BIOSIS products is provided through a variety of fields including author, title, and abstract. Access to records is further enhanced by the BIOSIS indexing process. BIOSIS indexers add keywords consisting of both natural language vocabulary provided by the author in the source text, as well as controlled vocabulary. Controlled keywords include drug action terms, chemical action terms, new taxa designations, and document types. Controlled keywords are also used to identify important new research areas.

All of the literature in the BIOSIS database is categorized into broad subject areas such as "Grain Crops" and "Weed Control." In the print products, these concepts are used to organize the records into sections. In online products, these concepts become important searching tools. Organisms are classified into taxonomic categories at a level higher than genus-species, such as phylum, class, order, and family, in the *BIOSIS Previews* database, but not in *Biobusiness*.

Agricultural Coverage

As mentioned previously, BIOSIS monitors over 9,000 serials for its database. Serials focusing primarily on agriculture represent 17% (1552 titles) of these journals. An analysis of their geographic distribution (Table 1) shows that Europe and North America are the largest contributors, contributing 40.1% and 21.3% of the journals, respectively. Asia and the Pacific nations and Latin America are the next largest contributors, supplying 11% and 9.8% of the journals, followed by Japan (8%), Africa (5.6%), and Australia and New Zealand (4.2%).

Agricultural Titles Monitored by BIOSIS in 1989		
Geographic Distribution		
Area	Number of Journals	% of Total
Europe (Including USSR & Middle East)	622	40.1
US & Canada	330	21.3
Asia & Pacific (Excluding Japan, Australia, New Zealand)	170	11.0
Latin America	152	9.8
Japan	125	8.0
Africa	87	5.6
Australia & New Zealand	66	4.2
Total Number of Journals	1,552	100

Table 1.

The total number of records contained in *BIOSIS Previews* (1969-Present) is in excess of six million records. Between 1987 and 1989, a total of 1,551,000 records was added to *BIOSIS Previews*. As can be seen in Table 2, literature pertaining to agriculture and agriculture-related areas comprised 166,921 records, or 10.7%, of the total number of records. Annual coverage of agriculture increased from 52,544 records in 1987 to 57,022 in 1988, and to 57,355 in 1989.

Since its inception in 1985, more than 200,000 records have been added to *Biobusiness*; 143,561 records were added between 1987 and 1989. Agriculture and agriculture-related areas represent a much more significant area of coverage than in *BIOSIS Previews*.

Results of coverage analysis, depicted in Table 2, show that 57,549, or 40%, of these records focused on agriculture and agriculture-related areas. This reflects the fact that *Biobusiness* emphasizes the applied areas of biology, with agriculture being one of the largest of these areas. As in *BIOSIS Previews*, annual coverage of agriculture in *Biobusiness* increased steadily from 15,355 in 1987 to 20,360 in 1988, and to 21,834 in 1989.

BIOSIS Coverage of Agriculture-Related Subject Areas		
Number of Cites per Year		
Year	Previews	Biobusiness
1987	52,544	15,355
1988	57,022	20,360
1989	57,355	21,834
Total	166,921	57,549

Table 2.

Coverage of agriculture is divided into a number of broad concepts for both *BIOSIS Previews* and *Biobusiness*. These include: Animal/Poultry Production, Veterinary Science, Economic Entomology, Phytopathology, Agriculture, Weed Control, and Soil Science. These broad concepts are subdivided into more specific concept headings shown in Tables 3 and 4. In *BIOSIS Previews*, "Economic Botany," "Agronomy," "Horticulture," and "Forestry and Forest Products" are considered as separate broad concepts, whereas in *Biobusiness* they are grouped under the broad concept "Agriculture." For the purpose of comparison, these broad concepts in *BIOSIS Previews* were also grouped under "Agriculture." A breakdown of annual and total coverage for each of the broad concepts can be found in Tables 5 and 6.

Agriculture-Related Subject Areas Indexed in BA, BA/RRM, BIOSIS Previews	
Broad Concept	Concept Heading
Animal Production	General; Methods
	Feeds & Feeding
	Breeds & Breeding
Poultry Production	General; Methods
	Feeds & Feeding
	Breeds & Breeding
Veterinary Science	General; Methods
	Pathology
	Microbiology
Economic Entomology	General
	Field, Flower & Truck Crops
	Fruits & Nuts
	Stored Products
	Trees, Ornamentals & Wood Products
	Animal Pests
	Biological Control
	Integrated Control
	Chemical & Physical Control
	General; Apparatus
	Apiculture
	Sericulture
Phytopathology	Diseases Caused by Fungi
	Diseases Caused by Bacteria
	Diseases Caused by Phanerogams
	Diseases Caused by Algae
	Diseases Caused by Animal Parasites
	Diseases Caused by Viruses
	Nonparasitic Diseases
	Parasitism & Resistance
	Disease Control
	General & Misc.

Table 3.

Agriculture-Related Subject Areas Indexed in BA, BA/RRM, BIOSIS Previews	
Broad Concept	Concept Heading
Agronomy	General; Misc. & Mixed Crops
	Grain Crops
	Forage Crops & Fodder
	Fiber Crops
	Sugar Crops
	Tobacco Crops
	Oil Crops
	Weed Control
Economic Botany	Economic Botany, General
Horticulture	Temperate Zone Fruits & Nuts
	Tropical & Subtropical Fruits & Nuts
	Plantation Crops
	Small Fruits
	Vegetables
	Flowers & Ornamentals
	General; Misc. & Mixed Crops
Forestry & Forestry Products	Forestry & Forest Products
Soil Science	General; Methods
	Genesis, Morphology, Classification, Geology
	Physics & Chemistry
	Fertility & Applied Studies

Table 3. (cont.)

In both *BIOSIS Previews* and *Biobusiness*, "Agriculture" is the broad concept with the highest number of records, representing 50% and 64% of agricultural coverage, respectively. This is not surprising since "Agriculture" encompasses the greatest number of specific concept headings. "Soil Science," "Phytopathology," and "Animal/Poultry Production" are also important coverage areas in both products. Among these three headings, in *BIOSIS Previews* "Soil Science" has the highest number of records, while in *Biobusiness*, "Animal/Poultry Production" has the highest.

Agriculture-Related Subject Areas Indexed in Biobusiness	
Broad Concept	Concept Heading
Animal Production	General & Methods
	Feeds & Feeding
	Breeds & Breeding
Poultry Production	General & Methods
	Feeds & Feeding
	Breeds & Breeding
Veterinary Science	Veterinary Science
	Veterinary Toxicology
Entomology	Economic Entomology
	Bees & Apiculture
	Silkworms & Sericulture
Plant Studies	Plant Disease
Agriculture	Economic Botany
	Crop Production
	Fiber Crops
	Flowers & Ornamentals
	Forage & Fodder Crops
	Fruit Crops, Nut Crops & Plantation Crops
	Grain Crops
	Oil Crops
	Sugar Crops
	Tobacco Crops
	Vegetable Crops
	Forestry & Forest Products
Weeds & Pests	Weeds & Weed Control
Soil Science	Soil Science

Table 4.

BIOSIS' coverage of the life sciences is still growing, and agriculture continues to be an important area of coverage. In 1990 BIOSIS will add 535,000 records to the *BIOSIS Previews* database. Thus far (January-February 1990), over 126,000 records have been added to *BIOSIS Previews*, with over 13,000 (10.9%) of those records focusing on agriculture. *Biobusiness* will add approximately 85,500 records in 1990. Over 5,000 (31.3%) records out of the 16,500 added in the first two months of 1990 were related to agriculture.

BIOSIS PREVIEWS					
Agricultural Coverage 1987-1989					
Broad Concepts	1987	1988	1989	Total 1987- 1989	1990 Jan.- Feb.
Total Agricultural Information *	52,544	57,022	57,355	166,921	13,735
Animal/Poultry Production	9,566	10,963	10,191	30,720	2,279
Veterinary Science	7,288	7,522	7,765	22,575	2,237
Economic Entomology	7,680	7,962	7,945	23,587	1,630
Phytopathology	10,231	10,027	10,601	30,859	2,820
Agriculture	26,327	28,582	29,972	84,881	7,047
Weed Control	1,744	1,863	1,555	5,162	330
Soil Science	10,742	11,149	11,875	33,766	2,805

*Due to overlap of material within a particular year, total agricultural information is not an additive quantity.

Table 5.

BIOBUSINESS					
Agricultural Coverage 1987-1989					
Broad Concepts	1987	1988	1989	Total 1987- 1989	1990 Jan.- Feb.
Total Agricultural Information	15,355	20,360	21,834	57,549	5,170
Animal/Poultry Production	3,511	5,307	5,964	14,782	1,488
Veterinary Science	1,068	1,086	1,737	3,891	417
Economic Entomology	2,171	2,357	2,443	6,971	448
Phytopathology	3,577	3,668	3,697	10,942	672
Agriculture	9,574	13,017	14,112	36,703	3,336
Weed Control	840	952	816	2,608	184
Soil Science	2,105	2,288	2,619	7,012	526

*Due to overlap of material within a particular year, total agricultural information is not an additive quantity.

Table 6.

Specialty Products

The products mentioned thus far are comprehensive in coverage. However, BIOSIS also produces several specialty products that focus more specifically on agriculture. These products are also available in a variety of formats and are designed with the individual researcher in mind. Among these is the *International Bibliography Series*^R, a printed publication containing bibliographic references derived from the BIOSIS database. The series includes the *International Bibliography of Acid Rain*, the *International Bibliography of Citrus Crops*, the *International Bibliography of Corn*, and the *International Bibliography of Soybeans*.

BioResearch Today^R, a group of monthly current-awareness journals containing abstracts selected from the two latest issues of *BA*, also contains titles specific to agriculture and agriculture-related fields. *Human & Animal Parasitology*, *Pesticides*, and *Nitrogen Fixation* are examples.

*Abstracts of Entomology*TM is another monthly current-awareness journal. It contains abstracts and content summaries derived from the BIOSIS database focusing on such topics as chemical, physical, and biological pest control, economic entomology, and pathology. *Abstracts of Mycology*TM is a similar product containing abstracts and content summaries of research studies involving fungi, lichens, and fungicides. BIOSIS *Standard Profiles* is a current-awareness service which provides comprehensive coverage on a specific topic. The records are printed out on computer paper and are sent to individual and corporate subscribers on a monthly basis. Twenty-eight topics are available; of agricultural relevance are *Bioclimatology & Biometeorology*, *Fungal Diseases of Corn*, *Herbicides*, *Insect Chemosterilization*, *Pesticide Residues in Soil*, and *Plant Growth Substances*. *B-I-T-S*^R (*BIOSIS Information Transfer System*) and *C.L.A.S.S.*^R (*Current Literature Alerting Search System*) are current-awareness and retrospective services which provide subscribers with records derived from the BIOSIS database using customized search profiles based on the subscriber's field of research. The records are sent on disks or tapes on a monthly basis for *B-I-T-S* and on computer cards or paper four times a month for *C.L.A.S.S.*

Conclusion

Over the years, BIOSIS has expanded its services and product lines in a continuing effort to broaden its offerings and to meet the changing requirements of the life science community. The needs of the individual researcher are addressed by a wide range of current-awareness products. Users can also take advantage of BIOSIS' implementation of emerging technologies, such as the introduction of *Biological Abstracts on Compact Disc* in the beginning of 1990.

BIOSIS will continue to provide biologists and researchers with information vital to their needs, as it has for the last 60 years.

On the Exploitation and Utilization of Agricultural Sciencetech Information

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Abstract

In the course of the 'two changes' realized in China's agriculture, the information services of agricultural sciencetech have been appearing to be more and more important. The main contradiction between information collection and utilization must be solved in agri-sciencetech informational research. The regional information research unit of agri-sciencetech should address agricultural production in the local area. Its informational work is to pay particular attention to serve the specialized agricultural sciencetech household, so the service function of sciencetech information must be stressed further.

The exploitation and utilization of agri-sciencetech information, means to activate the information into actual techniques, and to transfer the actual techniques into productive forces. The "activating" and "transferring" are determined by the characteristics of farm production and the conditions of economic techniques in China. The information service should combine information collection and research with information exploitation and utilization, introduce this information work to commodity production fields in the countryside, implement rewarding services, promote the development of agricultural production, and attain the economic and social efficiency of information service, which is not only the starting point but also the end-result of agri-sciencetech information work.

I. Strengthen the Service Function

It is in an era when a revolution in new techniques is developing vigorously in the world, that China's agriculture is realizing the course of "two changes." The dependence of agricultural production on agri-sciencetech developments are appearing to be more and more and more necessary. So it is more and more important to do a good job in agri-sciencetech information service. The main contradiction throughout the process of agri-sciencetech information work lies between information collection and information utilization. And the key challenge is how to help the user utilize information. Therefore, the information service must adopt different methods to serve different targets and use various ways and methods to satisfy the user's basic needs for sciencetech information. So it is not only the starting point but also the end-result for an information service to establish and perfect a suitable information service system, to fully exert the work efficiency of sciencetech information personnel, to attain better information effects and economic benefit, to make a fruitful contribution to the economic construction in the countryside.

As the regional information research unit of agri-sciencetech should address the agricultural production of its local area, its information service should pay particular attention to the "specialized agricultural sciencetech household." The economic development of the countryside depends both on economic policy and on science and technology. The specialized agricultural sciencetech households are very interested in science, and require accurate sciencetech information. Supplying information services and sciencetech consultation for these specialized agri-sciencetech households will greatly promote the development of commodity production in rural areas and speed the realization of the "two changes." The transformation of information service will inevitably strengthen the function of sciencetech information services. The consulting function must move from its original reference nature to one of insurance; the former free service must transform into a fee-based service. Therefore, information service must be seen as a business with intelligent work as its capital. It can help the user seek the greatest economic efficiency, and assume the responsibility for the techniques and the economy, so it is reasonable to be paid a certain amount of money. Thus, the relationship between information personnel and users is not limited only to supply and demand, but also a new relationship has developed that combines information personnel and users under the overall aim of developing the economy of the countryside, and it is also the bridge to transfer agricultural sciencetech information into productive forces.

II. Activation and Transfer

Information service is one means to transfer sciencetech information into productive forces. The agricultural information service is an important medium that combines science and technology with agricultural production in order to raise agricultural productive forces and economic efficiency.

One of the objectives of exploitation and utilization of agri-sciencetech information is to activate the information into practical techniques, the other is to transfer the practical techniques into productive forces. The "activation" and "transfer" are decided by the characteristics of farm production and the conditions of economic techniques in the rural areas. First, the agricultural production cycle is long, and to a great extent, it is restricted by natural conditions. Second, the development of an agricultural economy is not balanced, the difference in productive conditions is very large, the peasants' scientific advancement is lower and the peasants lack the policy-making ability that they need to carry out commodity production; and third, at present the system for countryside commodity production is not perfect, and the information transmitting channel is not smooth. Under these circumstances, the key that the information services must find is how to transfer the sciencetech information into productive forces, and how to help the user make use of the information.

In the past few years, the information work in our institute has transferred from pure information collection and reporting to a multi-functional service of information collection--experimental digestion (activating)--technique training--technique consulting--directional service--commodity production. Which means that information collection and service have been combined with information exploitation and utiliza-

tion. The scientech information work has been directly introduced to commodity production fields in the countryside, implementing fee-based services, and attaining the economic and social efficiency of information service. This is the way of the future in information exploitation.

The transferring of agricultural scientech information should be divided into two steps: (1) Collecting the information and activating it rapidly into actual techniques. In the light of local conditions, potential scientech information was collected, then it was activated into actual techniques; (2) Transferring the actual technique into productive forces. By various methods of training, consulting and servicing, etc., to popularize the actual technique, the actual technique is mastered by the users (peasants), then it is used to develop commodity production, to heighten the economic and social efficiency. Activating and transferring makes up the main body of scientech information exploitation. It has been proven that it is an effective way for agricultural scientech information work to address economic construction in the countryside.

The information activating is decided by three factors: (1) The importance of the information for the agricultural production and development of the economy in local countryside, (2) The economic and social efficiency of exploitation of the information, (3) The possibility of information exploitation. For example, after thinking over these three factors, our institute decided on activating scientech information on an edible fungi, *Ampullaria gigas* Spix. Through experiment and practice, the newest practical techniques that are suited to planting and breeding in our city have been developed.

III. Exploitation and Utilization

Through information activation, we've developed practical techniques including interplanting of *Pleurotus membranes* in maize fields, *Pleurotus ostreatus* in apple orchards and growing of *Pleurotus ostreatus* in outdoor beds during the high temperature season. Interplanting *P. membranes* in maize fields has been successful, the output of the maize increased 15% and the *P. membranes* yielded 2300 kg, the rate of biological transformation is 115%, the net income per hectare increased 2,200 yuan. The fruit body yield per square meter of edible fungi grown in outdoor beds is 22 kg, the rate of biological transformation is 110%, the net income per square meter is 20 yuan. The successful practical technique of growing edible fungi in outdoor beds can omit the room cost, and make it possible to produce edible fungi during the hot season.

In order to speed the transformation, exploitation and use of activated information--practical technique, our institute has run nineteen training courses, and 1,089 peasants have been trained in two years. Once the students learned techniques to cultivate edible fungi, they all bought edible fungi seed and production materials from our institute and got better economic efficiency after they were put into operation. The yearly income of some of the students has reached over 20,000 yuan. According to statistics, the area planted in edible fungi in Tianjin municipality in 1988 was 33 thousand square meters, two times more than that in 1985, the edible fruit yield per year was over 500 thousand kg. The total output value reached over 1,000,000 yuan. Through information exploita-

tion, edible fungi production is now gradually forming a new industrial operation around our city.

On the basis of technical training, a cooperative network of edible fungi techniques has been established with our institute as the leading unit to provide technical consulting and supply edible fungi seed for over 750 members of the cooperative network. We also produce a bimonthly journal on edible fungi. It enables the edible fungi information service to have long-term, fixed goals.

Through the information feedback of the members of the cooperative network, our institute can understand and master problems existing in edible fungi production in rural areas, and forecast developing trends and prospects for the future. This circulation of information exploitation is pushing the development of the edible fungi industry in our city. By the exploitation and utilization of scientech information, the service function of agri-scientech information has been strengthened. In the past few years our institute has attained a net income of over 80 thousand yuan, through information activating, technique transferring, training courses, setting up cooperative services, providing edible fungi seed and technical consultation, etc. Implementing a fee-based information service may also promote the self-construction of our institute.

Exploitation and Effective Use of Scientific and Technological Information on Agriculture

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Abstract

The most effective ways of exploiting and using scientific and technological information on agriculture in our country are to provide a pre-service for policy-making bodies, to offer information at home and abroad to scientific research projects and to supply peasants with knowledge about producing commodities. It is especially effective in serving the thousands upon thousands of peasants in the vast countryside of China to turn "soft technology" in the printed literature of science and technology into "hard technology," which are audio recordings and video tapes that peasants are willing to accept. In this way, scientific information and technology will be converted more effectively into productive forces, which will really enrich peasants with knowledge. In the future, we must increase the exploitation and utilization of scientific information, popularize agricultural technology and literature at a higher level in the countryside and pay much attention to improving the intellectual capabilities of information specialists. At the same time, we should also carry out reform in our information institutes with users as the center and the exploitation and use of informative literature as the key link and thus make our institutes real centers of collecting and distributing scientific and technological information.

It's a new strategic subject for scientific research: How an information institute at the provincial level strengthens the exploitation of scientific and technological information resources, and provides very effective, high-quality service for society in different fields. An information institute should serve mainly agricultural policy-makers, scientific researchers and peasants. In recent years, we have shifted the focus of our work to the exploitation and use of information to provide pre-service for policy-makers, to offer comprehensive, quality service for scientific research, and advance the technique for turning information into commodities for peasants. This is the correct way of making effective use of information.

1) Providing Pre-service for Policy-makers.

In recent years, science and democracy in policy making have aroused more and more attention among leading bodies at all levels. Before determining policy, leaders have to know about achievements in related fields, and the present developments both at home and abroad. But there is so much information that it is nearly impossible for them personally to look into the sea of materials. Therefore, it is an important function to provide timely, first-hand information for leaders in order to make quick scientific

decisions and avoid losses. In the projects of "The Demonstration of the 7th five-year plan", the loan from the World Bank, the Exploitation of Hainan Island, and in some introductions of new techniques, we had information specialists collect information, investigate the research levels in related fields, and study their present conditions and developing tendencies. Thus we provided them with background material, reference data, and a documentary summary; in addition, we put forward our constructive statements, with the help of which, the perspectives of the policy-makers have been broadened, their thinking enlightened, and limitations and blind spots in their decisions avoided.

In 1986, we had a demonstration of this in whether to introduce a certain technique to produce virus-free plantlets of deciduous fruit trees. By investigating a number of reference materials, we learned that this technique is an effective means of quickening the propagation of virus-free plantlets, improving the quality and taste of fruits, and advancing the development of fruit trees in the middle-upper reaches of the Yangtze River. In this field, Italy already has well-developed techniques and advanced equipment. So the decision was made, the introduction was successful, and additionally, we were able to get international financial assistance for this project.

In the same year, a business man from Chicago came to Sichuan to promote his sales of equipment for extracting protein from leaves. Detailed information provided in time by our library showed that this kind of equipment was out-of-date, so, its introduction was rejected, and losses were avoided. At present, we are going to set up a "Reading Room of Agricultural Information in Sichuan," the purpose of which is to collect, study, catalog and demonstrate all kinds of data about natural resources, agricultural meteorology, population and economy in our province in order to offer the possibility of predicting periods of natural disaster in our province and taking appropriate measures.

2) Providing Convenient Service for Scientific Research.

Scientific research requires that the library should be a center of collecting and distributing the latest information in the world so as to provide a comprehensive and selected information service for researchers. We often analyze and study the latest scientific and technological information related to research subjects and then supply the researchers with cataloged materials. In service to seed-breeding of the six major crops, we offered timely and comprehensive information about the latest agricultural developments and selected the most valuable information and published it in pamphlet form. In 1988, our catalogs of information about rice, rapeseed and sweet potato amounted to 31 issues with 2,398 entries all together. In 1989, 38 issues with 3,876 entries all together. So, our researchers always informed with the latest information at home and abroad about new developments in their fields. We also put emphasis on information services to meet the special needs of leading researchers in various subjects. In Sichuan, researchers in the study of developing hybrid rice met with the problem of a low germination percentage among the seeds bred on Hainan Island. This problem was an obstacle to the development of hybrid rice. To help solve this problem,

our information specialists investigated many source materials. Finally, they found an experiment report about rice in western Africa, in which a way to break up the dormancy of most seeds and to raise germination percentage was reported. After the method was adopted, an additional income of about 600,000 Yuan was attained from 1977-1981. In serving the research subject of "Zn Fertilization of Rice" in our institute, our information specialists had made a summary from more than ten articles covering the theories, methods and effects of Zn fertilization in rice-growing countries, like Bangladesh, India and the Philippines. When the researchers had these references, they immediately decided on their research approach, perfected the details, and what is more, the research was accomplished ahead of schedule. We have done lots of work in providing information for some research projects, such as a new breeding of super high-yield rice; wide compatibility, photoperiod sensitive genic male sterile rice; application of tissue culture in crop breeding. Book-lending, copy-making and offering-information-to-doorsteps services can also be found in our library. Scientific workers have praised our information service as "rich in information, original in content, purposeful in selection, and very good in guidance to action." They also praised us for quickening their research process by offering timely information.

3) Aiming at the Chinese Countryside, Providing Multi-purpose Service for Peasants.

At present, all peasants are eager to get rich. They are hungry for scientific knowledge and market information, but their disadvantages are that they are living in scattered regions with inconvenient transportation, and that their educational level is low. If they are only given very general information, it's hard for them to understand and make use of it. So, it's necessary to give them a special information service to meet their needs so that they can apply it to their production and bring about desired economic effects. The way we do this is to first collect and sort out some kinds of valuable information which are still relatively unknown and unpopularized, then we turn these materials into audio recordings or video tapes and convey them to peasants by means of radio broadcasting and television in the form of "technique lectures" and "special training," which are favored by peasants, and have good results very soon. It's very useful to lead peasants to wealth by making use of scientific and technological information.

In 1988, we took advantage of market information and our library held a course in "Growth of High Yield Strawberries" jointly with the People's Broadcasting Station of Sichuan. The peasants in the whole province learned that this can have immediate economic benefits in a short time, and many of them were active in joining the course. The specialists for the course gave detailed lectures on the growth of strawberries, its introduction, cultivation, prevention of insect pests and disease, and fruit processing techniques. As a result, the technique of cultivating strawberries was soon spread to all places in the vast countryside of Sichuan province. The following year, all markets in the towns and villages of the province were supplied with an additional 70,000 Kg. of strawberries, and peasants had an additional income of more than 400,000 Yuan.

"Rice Straw Biotic Feed" is a successful research project accomplished by our province. The technique needs little investment, but has quick results. If the biotic feed is used in pig-feeding, it can substitute for about 50% of the grain feed. The written materials describing this technique ran to about 20,000 words, which was too difficult for peasants to understand, so we turned the written materials into a twenty-minute TV show, which was easily understood and accepted by peasants, and the technique has opened up a new feed source for peasants, and relieved the shortage of feed grain to some degree.

We have another example of this kind. In the development of silkworms, Sichuan has a high gross output, but low yield per unit, low quality and low productivity. To solve this problem, the information specialists in our institute found more than 170 reference articles about silkworm development for the silkworm raisers of the county whose staple products are silkworm cocoons. We borrowed others' experiences and made "A Series of Technique in Silkworm Breeding" mainly to solve the problem of low per unit yield. Consequently, the per unit yield was raised by 16.4% in 1988. At the same time, the silkworm raisers have learned the techniques of "Preventing Silkworm Disease" and "young larvae rearing with complete leaves in three-dimensional forms," good results were obtained.

(4) The Outlook for Information Exploitation Services.

Information service is a bridge linking science and technology to society. The exploitation of scientific and technological information has found its place in social applications, but it is only a beginning. There is a lot of work to be done in serving policy-makers, in offering suggestions to scientific researchers, and in leading peasants to wealth. Particularly, the exploitation and use of scientific and technological information has a vast perspective in serving agricultural production and millions of peasants. We have to give multipurpose service according to the special needs of our customers, especially in turning "soft technology," that is, information which involves technology and techniques of material production, into "hard technology," and turning information into commodity knowledge for peasants. At present, special attention should be attached to the cultivation of new breeds, exploitation of new resources and processing of agricultural by-products in order to popularize new techniques.

To accomplish the above points, we have to:

1. Establish a network of information sources and dredge all channels for obtaining and distributive information. Agricultural scientific and technological information bodies at the provincial level should set up connections with science commissions at prefectural and county levels, with science and technology popularizing departments and cultural centers. All these units should cooperate closely to find more customers and to develop new services.
2. Pay attention to enhancing the intellectual capability of information specialists and their ability to access information so as to increase the storage capacity of scientech information.

3. Make more audio-visual materials available for countryside use in order to overcome the difficulties of low educational level among peasants, and to increase the utilization ratio of scientific and technological information by peasants.

4. Carry out customer-centered reformation in information bodies, put stress on information exploitation and use, give more consideration to customers. Relevant bodies and professionals should improve their information work of serving policy-making and scientific and technological research, and the agricultural development in the countryside.

On Information Obstruction

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Abstract

This paper suggests that there are two kinds of information obstruction during information transmission, namely, the obstruction of "homo-language" and the obstruction of "hetero-language." In the Chinese language, the transmission obstruction occurs between the simplified Chinese characters and the original complex forms as well as between the pictographic characters and the alphabetic writing system of Chinese.

With the rapid development of modern science and technology, barriers of hetero-language become more obvious, arising not only from the differences of language, but also from the differences in cultural background.

As the division of modern disciplines becomes more detailed, it produces barriers among scientists or information agents, who use the same language. Besides this, errors, missing segments and information inaccuracies may also occur during transmission. Usually, information agents aim to promote their work through positive reporting, they always neglect to mention the negative effects of transmission, so the author intends to put forward this problem for further investigation.

Introduction

There is a difference between "homo-language transmission" and "hetero-language transmission" during information transmission. It's called "information facsimile" if the transmission channel is thorough and clear; while it's called "information distortion" if interfered. (The information given by speakers or writers can't be thoroughly understood by audience or readers.) It's called "information appreciation" if the information understood by audience or readers is more than the information given by speakers or writers; while it's called "information depreciation" when the case is to the contrary. It's called "information deviation" if the understanding of information by audience or reader drifts away from the original information; while it's called "information suspension" if the audience or readers can't understand the information at all, i.e., information impediment. The distortion, depreciation, deviation and suspension during information transmission are called "intelligence obstructions."

The obstruction of homo-language transmission during intelligence exchange

If the information given by speakers or writers is called "encoding," and the information received by the audience or readers is called "decoding," homo-language transmission may be explained through a diagram as follows when exchange occurs in the same language:

writer (encoding)--> output information--> receipt--> reader (de-coding)

1. The barrier of transmission in Chinese

There are many different dialects in Chinese. But Chinese has gone beyond these differences and has been a unified written language since the First Emperor of the Qin dynasty, who unified the characters of Chinese. Overseas Chinese in Japan, Korea, Singapore and other countries also use the Chinese language. The countries and regions in which Chinese is used are called "the cultural circle of Chinese characters." In this circle, the information transmission of Chinese characters belongs to homo-language transmission, nevertheless, it can't be said that there is no barrier. Here are some facts:

A. The barrier between simplified Chinese characters and the original complex form.

During the 1950s, the early stage of the founding of new China, all together 2,236 simplified Chinese characters were approved to be used. As a result of popularization for thirty years, these characters have been used in all books, periodicals and other publications in China, which has brought about barriers between the simplified characters and the original complex forms. Abroad, the original complex forms of Chinese characters have continued to be used for these thirty years and readers can't recognize the simplified forms with the increasing exchange of books and periodicals at home and abroad when China opened its door to overseas. In order to clear away obstacles, *People's Daily* and *Keep a Lookout* issue their overseas editions printed in the original complex form of Chinese characters. Another case is that young people in China are unable to read publications from Hong Kong, Taiwan and other countries because of the original complex form of the Chinese characters. The simplified Chinese characters also create a barrier between ancient and modern times, which is a problem not only for the young generation. This barrier of homo-language transmission occurs in the cultural circle of Chinese characters, which was unexpected when the first simplified forms were spread.

B. The barriers between Chinese characters and the alphabetic writing system of Chinese.

In the early 1950s, the language reform originally aimed at having an alphabetic system of writing take the place of Chinese characters. The system has failed to take the place of Chinese characters during the past thirty years because a common dialect of the Chinese language and compulsory education were not popular. Even though the

phonetic letters are popular, there will be new impediments in information exchange, which include:

(1) barriers between those at home and abroad, which is more serious than the barrier between simplified Chinese characters and the original complex forms, and which is somewhat like hetero-language impediment in the cultural circle of Chinese characters.

(2) barriers between ancient and present time. If ancient books were printed in an alphabetic system of writing, the Chinese themselves might not understand them.

(3) barriers between the Han nationality and the minority nationalities. Chinese characters are not confined by the variation in speech sounds, but alphabetic writing requires one be able to read, to have comprehensive listening ability and to speak a common dialect.

C. The barriers caused by translated foreign words when Chinese characters were separately used in the Mainland and overseas, both sides translated a great number of foreign words from western documents of science and technology.

The new words have been a part of Chinese culture after being in use for a long time. There is difference in interpretation of the new words because they were imported separately, thus homo-language impediment appears when the words become specialized terms of Chinese. When the terms are not indicated in English, sometimes one may not know that the two forms of interpretation are referring to the same object or matter if he or she makes a judgment only from the Chinese characters, which usually exists in the translation of science and technology terms, a person's name, placenames, and daily life usage, for instance:

information
Laser
integrated circuit
channel
entropy
sustainable agriculture
green revolution
plastic
panda
park

The hetero-language impediment of Intelligence exchange

1. The pattern of hetero-language exchange

Information transmission of hetero-language has one more procedure than that of homo-language, the translation. The information output by A language speakers or writers must be code-changed, then, it could be understood by receivers who are B language speakers or writers. Look at the following pattern: Writer-->encoding-->

output information A--> interpreter (code change)--> output information B--> receipt--> reader (decoding)

If code-change is accurate and channels are unblocked, the exchange will be efficient. If there is any error in code-change, the information will be distorted and an obstacle will be made. Here are some simple examples: "the Galaxy" (the Milky Way) was translated into 'the road of milk;' 'Notre-Dame de Paris' into 'My wife in Paris;' etc.

When both sides of the information transmission (such as A and C) lack a medium of code-change, communication between A and C has to go through B. Here is the pattern of retranslation, which was formed by inserting another section into the last figure. (The pattern of hetero-language exchange.)

language A (encoding--> information A--> interpreter (1) (code change--> information B (language B)--> interpreter (2) (code change--> information C--> reader (decoding, language C)

There is difference between information exchange and translation though they are closely related. An interpreter sometimes simply does the job of code-change, not giving analyses and studies on the content he deals with; while an information agent has his own choice and target when he does translation, doing the job in order to meet the requirement of information. The further step will be document summary or study, the agent does not take one article as his object but a great number of articles, not directly changing codes after decoding but giving comprehensive analyses and showing the common tendency or abstracting law concerning the document. Decoding may involve not only one language but also several languages, thus, the code-change above should be expressed as following:

$d(1 + 2 + 3 + \dots n) \rightarrow S.A, \rightarrow S.I.$

In this figure, 1, 2, 3,...N represent the number of articles; d, the total deciphered documents; S.A, "systematic analysis;" S.I, "synthetic information."

According to the above figures, information agents should master one or more foreign languages to decode information, have more hetero-language capability in some specialized fields, and have the ability to think logically and to express themselves well in Chinese when they finally output the synthetic information.

2. The barriers of hetero-language exchange in modern times

It has been highly efficient to exchange information of science and technology in modern times by means of increasing channels for information transmission. Unblocked channels have brought about the so-called information explosion, which is too much for people to accept. Nevertheless, let us think it through carefully, because people have been paying a great price for high efficiency. By the seventeenth century in Europe, for instance, there was no hetero-language impediment because all scientists wrote in Latin. Language barriers appeared when each scientist wrote in his own native

language. But a scientist could read 92% of the world's documents on chemistry and the chemical industry, so long as he could read in English, in the early part of the seventeenth century.

Nowadays foreign languages other than English are beginning to appear in documents due to scientific and technological developments in many countries. The proportion of English documents has decreased from 92% to 66%, which requires that scientists understand several languages besides English in order to know the document situation all over the world. Most scientists in the United States understand English only because that language brings them much convenience, 93% of them cannot understand Russian, Japanese and Chinese which all together have been accounting for one-third of the documents in the world. Therefore, a scientist has to spend much time in learning foreign languages for clearing away language impediments when he may be in his best period to do research. If two scientists study the same subject, and one must learn a foreign language while the other doesn't, the former will suffer an invisible loss due to language impediment for one or two years.

3. Cultural background and barriers of hetero-language exchange

The barriers of hetero-language exchange sometimes appear not understandable because it can be understood but difficult to find a proper word to express it, which usually makes a person fall into a predicament. It's the difference of cultural background between two languages that make this a difficult position, especially in the translation of literature. In science and technology, barriers appear along with the cultural exchange at home and abroad. For example, hetero-language impediment occurs when we enroll overseas students from foreign countries and make an introduction about agricultural science courses in China. We are unable to find such corresponding foreign language terms such as "fertilizer" which in English means a mineral one, while "manure" means an organic one, but the Chinese word includes both mineral and organic, so it's difficult to translate it into the correct English term. There is no equivalent for the Chinese "yang" in English where there are only "goat" and "sheep." Whenever it's the year of Chinese "yang," people in the United States always ask: "Is it the year of the goat, or the sheep?" Sometimes, on the other hand, English terms cannot be expressed in Chinese words. For example, a crop rotation pattern called "ley" in England--a crop rotation system of two or more years including non-tillage or herbage and crop, is difficult to translate into Chinese with a corresponding expression. All of these are hetero-language impediments caused by cultural background. In order to overcome the impediment, usually we explain it with footnotes.

Impediment of intralanguage (existing in both Chinese and foreign languages)

The division of modern subjects and the information explosion have become a causality of each other. More and more information compels scientists to narrow their specialized fields, thus they can get a grasp on the world situation within a relatively smaller range, which will be of benefit to their further research at the same time. If a scientist does not narrow his field, he will surely be drowned in the sea of information. On the

other hand, as subjects go into more detail (There are more than 2,400 subjects now.), the great amount of accumulated information forces scientific books and periodicals to be divided into more detail as well, so it is with any research methods. (For instance, the China Agronomy Society has too many members together, so it has to be divided into groups to have their academic activities). Therefore, something new continually emerges in each subject, such as nouns, terms, formula symbols, diagrams, models and so forth. Scientists in different fields can read only within their own specializations, they have no time to learn something on other subjects even though they desire to do so. Information agents of science and technology were originally required to synthesize information well, now they have to divide their work. Reference books and handbooks become more and more numerous, but they cannot meet current requirements.

This exchange impediment is not caused by hetero-language transmission but by an impediment of intra-language, which scholars at home and abroad must face. Also information agents are clear that their knowledge structures have too many problems to tackle, they are under a great pressure of inner impediment of homo-language. Scientists in different fields are usually busy with their own research subjects, resulting in a situation in which everyone clears away snow in front of his own door, thus, incurring non-coordination and one-sidedness and harming the entirety of science.

Some research programs are on a grand scale as a whole, but we have to divide them into several parts without unified leadership when we start to deal with the programs. Therefore, results may contradict one another. Some proofs or theories which seem evident and reasonable for one subject may not be accepted by another. It is a great impediment of intra-language for facilitation among subjects, a term in subject A sometimes may need much effort for subject B to understand. Divided programs are easy for us to do deeper research and benefit the development of the subject itself, but it will be difficult for us to make an overall consideration. This is a knotty problem for information agents for they have trouble giving a proper and comprehensive evaluation of the information.

The information error, missing segment and inaccuracy

There are different levels for errors and missing segments of information:

1. The error in transmission of names and terms

During the hetero-language transmission, because of the error in decoding, it makes the receiver accept the wrong information. For example, the carbonized seeds of "Gu Zi" was discovered in the Neolithic ruins of Miaodi Kau in Henan province. "Go Zi" in spoken Chinese in the Yellow River valley refers to the foxtail millet, but in the Yangtze River valley, "Gu Zi" means rice. When this discovery is translated into English, foxtail millet becomes rice. So the foreign document reported that about 5,000 years ago, rice had been planted in the Yellow River Valley.

A translation in the newspaper *Reference Information* on March 20, 1983, said that the "cockscorn" has a rich nutritive value, its quantity of protein was more than that of

wheat, soybean milk and so on. Actually, "cockscorn" is the incorrectly translated "amaranth." China is the original source of amaranth, and the Chinese people have used this plant as a food for thousands of years. So the report completely reverses the facts, but other popular science magazines and newspapers give coverage to the news and made it popular.

2. The error takes place in understanding the content

This often happens in translating and introducing the information. For example, there is a skill in cell-engineering named 'the fusion of cell,' it was a German scientist Merxius who was the first man to make a successful plastid fusion of tomato and potato. When the test results were introduced, it was often propagated that a new plant which can produce tomatoes and potatoes had been obtained. In fact, it is a misunderstanding, because the purpose of the research is to pass the cold-resistant characteristics of the potato to the tomato through cell fusion which allows the tomato to be planted as early as the potato and need no plastic green-house to maintain its temperature thus making it possible to expand the planting areas northward.

3. The problem of missing segments and accuracy

The highest level of the information work is to offer advisory data for strategic decisions on national construction projects. Because of the breadth of the information service and the limitations of the labor, it is very difficult for us to escape the problem of missing segments and accuracy during information research. But the mistakes are different from that stated above.

From 1976 to the early 1980s, the problem of how to accomplish the modernization of agriculture has been discussed for many years in China. The agricultural science and technology research institutes have provided a great deal of information about how to accomplish agricultural modernization in various kinds of countries. Now we recall that there are some missing segments. For example, we study little about the relationship between agricultural modernization and China's traditional agriculture, and we pay little attention to the traditional agriculture, but the FAO of the United Nations pays more attention to the characteristics of China's traditional agriculture. The American, Dr. Wittwer has visited China three times. When he returned home, he gave a report to United States Department of Agriculture. He thought there were fifteen items that the United States could learn from the China. Among those items, the traditional agricultural technologies, e.g., the green duckweed, the interplanting, the multiple cropping, the domestic animals acupuncture anaesthesia, the soybean food processing technology, nevertheless, are neglected by ourselves.

Concluding Remarks

In the course of information exchange, collection, sorting, synthesizing, analysis, and introduction, the information agents always pay attention to raising their working efficiency and positive feedback. When someone encounters a problem in his work, he always looks it up in a reference book, inquires of a specialist or discusses it with co-workers, when the problem is solved, his work is likely over. He pays little attention

to treating it as a kind of information transmission barrier. If you do take notice of the barriers and analyze them, you can reach the same initial conclusions as above. Therefore, there are a lot of theoretical problems worthy of being considered.

Prospects for the Chinese Agro-library and Information Education

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Abstract

Reviews the forty-year development of agro-library and information education in China, and point outs that information education is facing three major changes: 1. Improving efficiency of information service, 2. Socialization of agro-library information service, and 3. Formation of an information industry. According to the Theory of Dissipative Structure, the library and information education system is an open system, with order-arranging as the core of its development. Hence a library and information education system must be a stable formalized system. It is suggested that in order to strengthen agro-library information education in the future, the following three measures be taken: 1. Training in information ideology and ability; 2. Adjustment of structure in agro-library and information education; 3. Enrich the courses of agro-library and information education and to closely integrate the education with social practice.

Through forty years of difficult development, education in library science in China has gradually taken its own shape suitable to the Chinese conditions. However, with the advancement of science and social development, Chinese education in library and information science is facing competition from new knowledge and intelligence. It is worth discussing how we can keep pace with the new situation; how we can apply modern scientific methods to study the optimization of the education system of agro-library and information, and the future trend of agro-library and information education.

1. How to Keep Pace with the Change of Agro-Library Information Education

In the late 1940s and the early 1950s, there was only a special course of library science in China (China Science and Technology University set up a Department of Information Science in 1959). Since Wuhan University established a Faculty of Science and Technology Information in 1976, some other colleges and universities of liberal arts, science and engineering have followed suit. Now more than twenty colleges and universities have opened up or are prepared to open up a Faculty of Agro-Library and Information Education. However, agro-library and information education was started quite late. It was in 1986 when a Department of Library Science was first set up in Najiag Agricultural University. Most of the agricultural universities now have opened courses in document retrieval, and some have offered scientific information lectures for both senior and graduate students.

By 1985 there were eighty educational institutions in China that had courses in library science, of which 47 had regular education while 33 had in-work education. Library science education in China is still young, it lacks experience in training orientation, in schooling methodology, and in personnel ability. The education of library science in China should keep pace with the changing situation in the following three aspects.

(1) The traditional method of manual service for documents needs must change into a highly efficient service of online retrieval from databases

Nowadays the quantities of databases are increasing rapidly in developed countries. Nearly a hundred per cent of citations to documents are stored in a database, and quite a lot are replicated in different databases. In recent years the storage of information using CD-ROM has been developing rapidly. The United States, Japan and Western Europe are planning to build systems for storing full patent documents using CD-ROM. It is expected that by the year of 1990 patent documents all over the world will be able to be searched through international communication lines. In face of such a situation, Chinese library and information education should readjust its training orientation, teaching program and personnel qualification norms. It is necessary to foster a group of information professionals who are good at information processing to keep pace with the rapid development of information technology. Meanwhile the professionals who are engaged in library and information services should be reeducated so that they can renew their knowledge and become better qualified.

(2) Socialization of Agro-Library and Information Service

With the deepening of rural economic reform in China, the Chinese peasants are more enthusiastic for developing commodity production. They are eager to learn science and learn how to use information. This situation compelled the agro-library and information workers to extend their service scope from scientific information to information on market, management and economy. Furthermore, in order to transfer the information into productive force and gain social and economic effectiveness, it is necessary to change the means for storing materials to make them useful for township enterprises and private householders in vast rural areas. Therefore we should train different kinds of information professionals, taking into account the requirement that library and information education should serve eight hundred million Chinese peasants.

(3) Formation of Information Industry Concept

People usually consider information as a new industry of the 21st century. There are two concepts to explain why information is an industry. First: the product of an industry should be a commodity, and the commodity must have values of utilization and exchange. Information reflects such values through delivery or exchange, while delivery or exchange is exactly the fundamental property of information, therefore information is a commodity; second, information can not be produced in a small-scale and closed way. It requires large-scale, cooperative production. The formation of an information industry breaks the long-standing idea that an information institute should offer its service freely. Information should become an essential social industry. It remains to be discussed how future library and information education can be suited to such new changes.

2. System Ideology in Library and Information Education

Mr. I. Prigogine, the initiator of the dissipative structure theory believed: in an open system far from equilibrium, quantitative changes may cause qualitative changes when its external condition reaches a certain threshold value. The continuous exchanges of energy and substance between a system and its environment will transform a system in a non-orderliness state in space, time or function to an orderly and stable one. From this principle, the following aspects must be analyzed in order to change the library and information education system into a stable and orderly one.

(1) Library and Information Education System—An Open System

The theory of dissipative structure holds that only opening up makes the exchange of energy, substance and information with outside world possible, that is the transformation from non-orderliness to orderliness. If it is an isolated and closed system, the entropy value certainly becomes larger, which will create confusion among the component parts of the system and will increase internal waste, namely the transformation from orderliness to non-orderliness. The opening up of an education system means: a) looking to the rest of the world in order to learn and use the educational experience of other countries better, to understand the new trends in science and technology, in library and information sciences, as well as the developing level and trends of agricultural science; b) education should break from the present situation in China in which education is divorced from society and should apply the knowledge and skill acquired in school to practical use.

(2) Order-Arranging Core to the Development of Library and Information Systems

The theory of dissipative structure discusses the mechanism, conditions and regulations that evolve a system from a confused and non-orderliness state to a stable and orderly state. If the library and information education system needs a stable and continuous development, the function of its subsystem should be in a stable and coordinated state to bring the coordinated effect of the subsystems into full play. The education system for agro-library and information should train its personnel with different educational levels, the junior, middle and senior levels. They should attain not only knowledge of agriculture but also knowledge of information. The form of schooling can be divided into regular, spare-time, self-taught, or training courses, if agro-library and information education is regarded as a system, the schools with different training targets and administration are its subsystems. The coordination among the subsystems is the core to order arranging.

(3) The Library and Information Education System Should be Far from Equilibrium State

According to the theory of dissipative structure, the state far from equilibrium means non-equilibrium of thermodynamic or non-equilibrium system but in the agro-library and information education system it means: a) non-equilibrium on the information quantity of teaching material, that is to say the teaching material should be updated continuously to meet the demand because agricultural science and technology are

advancing and the technological revolution in information science is rising; b) non-equilibrium on teaching methods, the present educational system needs new teaching methods but it is limited by traditional ideas and education levels, thus causing non-equilibrium; c) society needs a large quantity of agricultural information and has a more strict demand on information professionals, but the agro-library and information education is unable to meet those requirements, which also causes non-equilibrium in the library and information education system.

These further confirm that the library and information education system, just like other systems, also has the characteristics of dissipative structure. If the combined effect of its various subsystem are in full play, to the optimum result, the educational system will finally reach a new and stable orderly state, which will promote the advance of library and information education progressively.

3. Agro-Library and Information Education in the Future

Agro-library and information service is a very specialized and synthesized area and covers many subjects, so it has more strict demands on the qualifications of personnel. At present, the problem lies in students. Those who study agriculture lack knowledge of library science while the students specializing in library science have little knowledge of agriculture. Therefore, there are no qualified personnel to meet the social requirement. It is necessary to enhance students in the following aspects for overcoming these weak points.

(1) Training of Information Ideology and ability

Because of weak information ideology in the long past the social status of library and information service is very low. Historically, the Chinese library and information service copied indiscriminately the experience of the Soviet Union in the early 1950s, without training students in information ideology. To thoroughly overcome this weak point, we should start with the education in information ideology for the students by holding lectures on domestic and foreign developments in agricultural science and technology, on the future of agriculture, on fundamental knowledge in information science, as well as lectures on other intersecting and cross-related disciplines. These lectures can not only train students in information ideology but also widen their range of knowledge.

Information ability means the ability for people to access, analyze, use, and judge information acquired from computer terminals. Information ability is essential to future university students. Its training contents include: 1) the ability of collecting and sorting, which means the selection of useful information from hearsay, acquiring materials and documents, and then distinguishing and sorting them out; 2) the ability of thinking and judging, which means the process of judgment and absorption on the basis of collection and sort; 3) the ability of comprehensive expression, which means the ability to express information before inducing, analyzing and feeding back. Except for the arrangement of lectures on theories of information application and information technology and on information forecasting, the training of information skills should

also include out-of-class information surveys, training students with information ability through practice.

(2) Adjustment of Structure in Future Agro-Library and Information Education

(i). Adjusting the norm of qualified personnel

Different personnel should receive different training. The assignment of trained personnel should be strictly managed to prevent improper use of qualified personnel. Graduate students who are trained for strategic research and forecasting of agricultural information, and have the ability of invention are senior professionals while undergraduate students, trained in the application of agricultural information and management to the engineering of information systems are middle-level professionals; and students from polytechnic schools are junior professionals mainly engaged in service management such as audio/video services and computer operation.

(ii). Adjustment of education structure

We must have a reasonable proportion of senior, middle and junior professionals in developing the education scale. According to foreign reports, the general proportion in the information field was 1:2:4, while the proportion in China was 1:10:5 based on the statistics of information professionals in 27 provincial agricultural academics. Such a proportion means that many middle-level professionals were engaged in ordinary work. Only when a pyramid structure is formed, would the optimum professional structure be obtained.

(iii). Adjustment of form of schooling

The form of schooling requires both regular education and reeducation systems. The regular education system should be developed systematically. It is suggested that the Library and Information Education College of Wuhan University, which is the Training Center for Library and Information Education under the State Commission of Science, should assist agricultural universities to set up a faculty of agro-library and information, so they can increase their enrollment. Meanwhile reeducation should not be neglected because it has flexible and purposeful characteristics and becomes an indispensable part of future education.

(3) Teaching Courses and Methods for Future Agro-Library and Information Education

The content of courses in the faculty of agro-library and information education varies with its different training levels. Usually the courses are divided into information research and management, engineering of information systems, processing of information and information technology. The courses should also include agricultural subjects, such as outline of agriculture, genetics and breeding etc. Considering the fact that the faculty of library and information education in the future will require a wide range of knowledge, some courses related to other faculties and the Education of Modern

Methodology need to be arranged to enrich the content and widen the range of knowledge. The application of an open teaching method in which education is closely integrated with social practice gives students an opportunity to acquire and process their information. When the information investigation course is arranged, students can take part in special observations and social investigations, write various information papers, go to the countryside to pass on information and offer information advice, and can enhance their ability in analyzing and solving problems they encounter in practice.

A Database of Bamboo Abstracts

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Abstract

Bamboos are widely distributed in the tropical and subtropical areas of Asia and the Pacific, to some extent they also occur in Africa and South America. Due to their fast growth, easy propagation, soil-binding properties, short rotation and the long fibre of culms, bamboos are ideal plants for use in afforestation, soil conservation and social forestry programs. As a result of the rapid decrease of tropical forests in recent decades much more attention has been paid to the cultivation and utilization of bamboo. Bamboo societies have been set up in America, Europe and in Asian countries. Hundreds of bamboo research papers are published annually, some 200 of them are from China.

In order to enhance the international exchange of bamboo information the Bamboo Information Centre, supported by the International Development Research Centre of Canada (IDRC), set out to establish a computerized database of bamboo literature for retrieval and to publish Bamboo Abstracts in Chinese and English versions. Methods of work are discussed and details described.

INTRODUCTION

It is said that over 75 genera and 1,250 species of bamboos occur in the world. They range from plants the size of field grass to giant trees of great height and thickness. They grow from the sea-level tropics to some 4,000-meter mountain slopes, occurring mainly in the tropical and subtropical areas of Asia and the Pacific. They also grow in Africa and South America. The most striking characteristic of bamboos is their vertiginous growth. No other living thing grows so fast. Near Kyoto a Japanese scientist measured the world's record. A culm of *Phyllostachys bambusoides* grew more than one meter in 24 hours. By watching it closely, one should have been able to see it grow. Another distinguishing feature of bamboos is their adaptability to various environments with different climatic and soil conditions. In addition bamboos propagate themselves easily by vegetative means.

Bamboos form the single most important item of forest produce used by rural communities in Asia. Their use as a long fibre raw material in the pulp and paper industry is well known and is one of the much sought after raw materials in the tropics. Their use in housing, agricultural pursuits, the fishing industry, basket making, transport systems both on land and water, handicrafts and the production of edible shoots is extremely important. Their extensive rhizome-root systems play a significant role in

soil conservation on river banks and hill slopes. The cultivation and utilization of bamboos offer more job opportunities to local people and increase their income, thus improving the stability of rural communities and the harmony of the whole society. For example, the Philippine Human Resources Development Center, a part of an ASEAN-wide Human Resources Development Program for technology transfer is developing successfully. An important part of its work is the development of manpower in cottage industries. It aims at upgrading the qualifications and competence of craftsmen in woodcraft and bamboo industries.

As a result of the rapid decrease of forests on earth, and particularly in the tropics, people pay more and more attention to the cultivation and utilization of bamboos. Consequently they deserve an improved status in the forestry literature and greater study in depth.

China is one of the most important bamboo producers in the world and bamboo has been closely bound with the life of the Chinese people throughout history. Some four thousand years ago our ancestors began to weave bamboo mats and baskets. Before the invention of paper they kept historical and cultural records on bamboo slips. They used bamboo brushes to write and bamboo arrows and bows to fight. Over one thousand years ago, the ancient Chinese scholar Dai Kaizhi recorded in his *Bamboo Manual* sixty-one types of Chinese bamboos. Later on there were further descriptions of bamboo varieties, distribution patterns, shapes, characteristics, habits and cultivation techniques in many other scholars' works. Nowadays hundreds of bamboo research papers are being published annually around the world, and some two hundred of them are from China.

In order to improve the international exchange of bamboo research information the Bamboo Information Centre (BIC) was established with support from the International Development Research Centre (IDRC), Canada and the Chinese Academy of Forestry (CAF), the People's Republic of China. The main activity of BIC is to establish a computerized database of bamboo literature for retrieval and to publish a semiannual periodical *Bamboo Abstracts* both in Chinese and English.

A DATABASE OF BAMBOO LITERATURE

Generally speaking, the amount of bamboo literature is not very large, but the papers are scattered in various periodicals, such as forestry, agriculture, light industry, civil engineering and mining industry. Furthermore, there are lots of other kinds of publications like proceedings, monographs and theses, devoted to bamboo research. This causes enormous problems for professionals to identify and locate. Obviously, a computerized database is needed for document retrieval. Since, as mentioned above, the amount of bamboo literature is not very large, it is possible to establish the database on a microcomputer. With financial assistance from IDRC, we obtained a North Star NS1200 microcomputer system, which is compatible with the famous IBM series.

At the beginning of our work we wrote a computer program for retrieval and typesetting of publications, both in Chinese and English. Later on we learned that a program for document retrieval called CDS/ISIS, recommended by UNESCO, had been widely adopted by many Chinese and foreign information institutions. For the purpose of effective information exchange our computer engineers wrote a program for the conversion of data from our own system into CDS/ISIS and vice versa.

In such a vast country as China most southern provinces engage in the cultivation, utilization, research and development of bamboo. In recent years, due to the serious shortage of ordinary wood and the rapid development of a market economy, new forms and technologies of bamboo utilization have been created, and workshops on bamboo research are being held in many provinces. It is impossible to collect all this information promptly without an efficient national network. To organize the bamboo information and comply with our objectives, we have formed a bamboo information network, consisting of some thirty persons from all the southern provinces of China. They are employees of universities, research institutions, governmental bodies and enterprises. With the help of this network we receive all important bamboo information from all bamboo cultivating provinces in a timely and regular fashion. All the members of the network are capable individuals, but that does not mean they can work in harmony with each other and offer information according to our procedures naturally. The proper function of a modern information network is only attainable with well-trained members, but such individuals do not exist in our country. They must be trained in accordance with our requirements. For this purpose we organized workshops of network members. In these workshops our colleagues explained the structure of the classification system of forestry literature, the thesaurus of forestry terminology, the principles of indexing, the rules of abstract compilation and the input sheet form for computer storage. Members also discussed the proper distribution of work among themselves. Consequently the information comes to us without overlapping, in due form and in due time.

BAMBOO ABSTRACTS IN CHINESE AND ENGLISH

The *Bamboo Abstracts* are published semiannually in two versions: Chinese and English. Every number includes 150 references, some 100 references are edited in Chinese and translated into English, some 50 references are edited in English and translated into Chinese. The abstracts are classified according to the Universal Decimal Classification System for the English version and the Chinese Bibliography Classification System for the Chinese version. All the references are indexed in same way for both versions.

For better translation and indexing a microthesaurus of bamboo terminology is being compiled. Some 2000 terms, including those of bamboo species, taxonomy, cultivation, protection, investigation, processing, utilization and management, have been selected.

The English language is not very popular in China. The compilation of the English version of *Bamboo Abstracts* has met many difficulties with the language barrier. With

an oriental language for a mother tongue, we Chinese often find it very difficult to express our ideas properly in English. Along with the language barrier, the different ways of reasoning and different styles of expression between persons of different cultural backgrounds also present lots of difficulties.

We Chinese are used to building sentences in a natural order, in the active voice. In our opinion the subject of a sentence should be arranged at the beginning, followed by a predicate, and then objects, both indirect and direct. Sentences of such a pattern are widely received in Chinese language, but once you translate them into English, sometimes they sound verbose, and sometimes even tedious. Some of our abstracts are crammed with such clauses as: "This paper described the process of...", "The author suggested that..." Actually these clauses don't make any sense to readers. Most of them should be deleted from the English translation. We reviewed some research papers written by native Englishmen and found many of the sentences were built in the passive voice. Such sentences read laconic and clear, they tell us the most interesting points: what has been done and how it was done. It goes without saying who did it, of course the author did. So it is of no use to mention it. Our translators should try to think and express themselves in English as Englishmen do. In this way, and only in this way can we improve our English competency.

Some of our compilers do not understand the real meanings of abstract work, they often write many facts which are known to information users. Examples are as follows: "Strong seedlings should be raised from high-quality seeds," "Proper fertilization will facilitate the growth of bamboo shoots," "A deep, fertile soil layer is better for bamboo growth," "Bamboos are grasses from the family Graminae." As our readers are educated professionals, they are very well acquainted with such common knowledge. Abstracts containing such ABCs are not informative for them. Our abstracts should be a source of information, not a textbook. Therefore such sentences should be deleted from *Bamboo Abstracts*.

Another question is how to indicate the geographical positions and seasons clearly and scientifically in English for foreign readers. Most of our abstracts are taken from Chinese local periodicals. The geographical positions are generally stated in detail, for example, "Dongshan village, 10 kilometers north of Taipin township, Taihe county." These data are quite useful for local readers, but they mean nothing for foreign ones, because on publicly available maps in English the foreign readers can find only the names of counties, and if you do not mention in which province the counties are located, it will be very difficult for foreigners to find them. We decided to indicate the geographical positions by mentioning the names of counties and provinces in our future numbers. Local terms for seasons are also widely used in local periodicals, such as "the period of peach flood," which means March of the Chinese lunar calendar, "small sunny spring," which means October of the lunar calendar. All these expressions sound strange to foreigners, and we will put them in correctly in the future.

Misspellings form a very troublesome problem in our work. They occur as a result of the poor English knowledge of the operator and the inaccuracy of translators. We often

find "referred to" instead of "referred to," "aboretum" instead of "arboretum" on proof-sheets. An ordinary Chinese proof-reader can hardly detect all these misspellings. In order to correct them we adopted the computer program WordStar 2000, which helps to find and correct all the misspellings. This caused more conversion procedures of the computer files. On the suggestion of IDRC officials we bought a copy of CDS/ISIS for document retrieval, which is recommended by UNESCO and widely used in many countries. In order to develop the international exchange of computerized data we ought to convert our file into CDS/ISIS, but for the preparation of printing mats for Bamboo Abstracts we must use a program called FORES, which was developed by our own staff, and in addition, for checking spelling we use WordStar. Sometimes such conversion procedures cause systematic errata so we have to carry out these procedures very carefully. Our software specialists are trying to simplify all these procedures.

Most of the abstracts are translated into English from other languages by various translators, which leads to inconsistency of translation. The names of institutions, periodicals and authors are often translated variously. For example, the Subtropical Forestry Institute and the Research Institute of Subtropical Forestry are one and the same institute; the *Newsletter of Forest Diseases & Insect Pests* and the *Bulletin of Forest Pests* are the same periodical; Chu Yuting, Chu Yu Ting, Chu Yu-ting and Chu Yu-Ting are the same person. A bamboo species could be written as *Phyllostachys pubescens*, *Ph. pubescens*, *P. pubescens*. Such inconsistency has resulted in misunderstanding by readers and the miscalculation of computers. Once the inconsistently translated terms are used as subjects for indexing, the computer prints out subject indexes and author indexes in a mess. Obviously, the standardization of translation is important and urgently needed. We compiled a concise guide to translators, telling them how to translate specific names, how to express the units of measure, and how to create abbreviations. According to this guide all the names of Chinese authors will be ordered as English names, the family name will be printed in full, and only the initials of the given names will be used. We believe this will raise the efficiency of editorial work and decrease the errors in keyboard operation.

There are many Latin names of bamboo species, insects and diseases in abstracts such as *Phyllostachys*, *Schizostachyum*, *Nechouzeana*, *Oxytenanthera*, *Aurantihumerala*, and *Shibataea*. Our operators often make mistakes in their spelling. To prevent such mistakes we compiled a key glossary in the program. All the Latin names are shortened. The short form of *Oxytenanthera* is Ox., Sch. is for *Schizostachyum*, D. is for *Dendrocalamus*, and so on. In this way, the operator puts in the short form and the computer converts it into the long form automatically. This will lighten the operator's work load and eliminate his/her errors.

CONCLUSION

The establishment of the database of bamboo literature and the publication of *Bamboo Abstracts* have improved the international cooperation of bamboo workers of all countries and increased their mutual understanding. We will make more efforts to fulfill our task better. As a newly-built small scale information institution, the Bamboo

Information Centre looks forward to developing links with all individuals and institutions dealing with bamboo cultivation, processing, utilization and research, and welcomes candid criticism and suggestions for the improvement of its work.

Multi Level Services for User Needs in Agriculture

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Abstract

The paper introduces the general situation of user needs at different levels in agriculture in China, and various kinds of library services which have been offered according to these user needs. Up to 1988, China had introduced more than 9,000 foreign agricultural and biological journals into the country. In order to make better use of these journals, the Chinese Agricultural Library Association coordinates the library collections of the main agricultural institutions in China and has held various meetings to promote interlibrary loans and avoid duplication of foreign journals. The National Union List of Foreign Periodicals and the Bibliography of Foreign Agricultural Books as well as other reference materials have been published for further information resource sharing throughout the whole country. The paper also presents the current status of library and information centers in disseminating agricultural information to their users in China.

Agriculture is the basis for the development of the whole national economy. In the rapid development of science and technology in today's world, it is particularly important to promote agricultural productivity which relates to the country's flourishing through science and technology. China now has a large contingent of agricultural personnel. The agricultural research institutions above the regional level have reached 1,122, employing technicians numbering 400,000. This amount could reach 4,000,000 if we include extension staff and agriculture related management staff. Furthermore, teachers and students in almost 70 universities and colleges and 360 secondary agricultural schools are also a major resource in agriculture. Following the development of inter-disciplines, more and more users in research fields in other subject areas are becoming agricultural information users, too. How to better serve all these users according to their needs is an important link in transforming agricultural information into productivity.

1. Developing Document Resources to Alleviate the Sharp Contradiction between Information Supply and Needs

Today, document resources are increasing fast. According to statistics, there are more than 800,000 items, almost 150,000 periodicals, over 5,000,000 scientific and technical papers, 1,000,000 patents, 4,000,000 technical reports and 1,200,000 standards published each year the world over. Its annual rate of increase is 13%. However, the documents' effective period decreases to 5-15 years. Publications registered in China

total over 7,000 titles which include 524 titles of agriculture related periodicals and newspapers (newspapers comprise 71 titles). It takes up 7.7% of the journal publications of the country. Up to 1988, the China Publication Import and Export Corporation introduced over 9,000 titles of agricultural and biological journals. However, as the library budgets have been limited, and publication prices have increased, library collections have been decreasing year by year. This causes a major contradiction between ever-increasing user needs and limited document resources. For dealing with the problem, we have adopted some precautions such as using international agricultural databases, etc. The two main ways to solve the problem are as follows:

1. Coordinating and Sharing of Agricultural Collections

To efficiently use the limited library budgets and avoid duplication or omission of valuable agricultural documents, we are trying to coordinate all the agricultural library collections in the country to become a planned "national collection" in order to systematically collect and process agricultural documents for better use of resources in the whole library and information system in China. In May, 1988, the Chinese Agricultural Library Association held its second annual meeting and organized the Committee for the Development and Use of the National Agricultural Document Resources. Its function is mainly to coordinate the agricultural collections of the country. Following the meeting, SDIC suggested a study on coordinating distribution and use of agricultural documents. Then, SDIC organized a coordinating meeting for 1990 foreign journal subscriptions in May 1989 in Shanghai. Each of the forty participants subscribes to more than fifty foreign journals each year. SDIC produced a national union list of 1,990 subscriptions to foreign journals of agricultural libraries which includes 103 libraries' collections of 3,749 titles in 1989. The participants at the coordinating meeting discussed and decided who the Chinese subscribers for each of the 1,990 titles should be, canceled some of the duplicates, and planned to offer a contents service among libraries for information exchange.

The Chinese Agricultural Library Association entrusted the library of the Zhejiang Agricultural University to be responsible for editing the National Union List of 1977-1988 Foreign Agricultural Books of 20,000 items from over fifty cooperating libraries. And SDIC produced the Union Bibliography of Foreign Agricultural Books (biannual) which contained more than 1,000 new items in western, Japanese and Russian languages. Following this, a symposium on coordinating the national foreign agricultural books is planned to organize this year.

Furthermore, an adjusting and coordinating meeting of the Chinese agricultural monographs and other documents will be also held soon.

2. Expanding the Grey Documents Collection and Utilization

The grey documents mean theses, dissertations, working reports, highlights compilations, technical reports, etc. According to rough statistics, the grey documents in agriculture above the regional level may be up to one hundred titles. These materials contain various information, special subject topics, news and trends which offer valu-

able information to learn about developments in agricultural science and technology. SDIC pays much attention to these materials and collects them by way of:

- sending acquisition librarians to attend some agriculture related meetings to collect proceedings or other materials;
- visiting agricultural units for useful materials;
- establishing exchange relations with agricultural units throughout the country;
- acquiring materials by mail-order from various agricultural units within the country.

The grey documents collection development requires us to spend even greater effort to get better results. We shall try to create more searching materials like dissertation indexes, special subject bibliographies, etc., for user needs.

II. Offering Wide Range and Multi Level Services to Users

As a developing country, China's average book rate per capita is rather low. There are 2.6 billion volumes in public libraries, 2.5 billion in university and college libraries, 0.2 billion in research libraries, 2.15 billion in scitech information institutes, totalling 7.45 billion so the average per person is less than one copy. This is much lower than some foreign countries. Within the whole collection, foreign books make up a small percentage. According to 1987 statistics, Chinese libraries' foreign collections contain about 3,000,000 monographs, 260,000 periodicals, and 5,000,000 miscellaneous materials. In the agricultural system, 103 units ordered 3,749 titles, for 23,079 pieces in 1989. However, the country has 420,000 agricultural scitech personnel. From this we can see that an average of 11.2 persons share one title, and 1.8 persons share one copy. If we include technicians and extension staff of 4 million, then, 1,066.95 people share one title, and 173 share one copy and the journals are normally collected by libraries in large cities. Libraries with more than 200 titles of major foreign journals are distributed in ten provinces (regions and cities) like Beijing, Jilin, Guangdong, Henan, Jiangsu, Zhejiang, Sichuan, Heilongjiang, Hunan, and Liaoning. Libraries which have more than 400 titles of foreign journals are all located in Beijing, totalling 1,871 copies, which amounts to takes up 32.5% of the whole country's 5,762 copies. However, in remote areas like Ningxia, there are only eight copies in the whole area. To deal with such uneven distribution of documents and expand the use of these documents, we have offered various services.

1. Editing and distributing agricultural bibliographies

SDIC has published its *Bibliography of Foreign Materials of Science and Technology: Agriculture*, monthly, since 1980. It includes 48,000 citations in various subjects annually.

2. Abstracts or full text translation of foreign materials

This service offers a convenient service for Chinese scientists who have language problems, and saves much time for them in locating and translating the needed

information. SDIC and some other institutes publish more than thirteen titles such as *Abstracts of Foreign Agronomy*, *Abstracts of Foreign Soils and Fertilizers*, *Translations of Agricultural Papers*, *Translations of Agriculture of Science and Technology*, *Translated Papers in Agriculture*, *Translations of New Technologies and Methods in Agriculture*, etc. These journals annually report 140,400 entries of agricultural information, and the 74 translated bulletins report 361,416 papers annually. Some institutes like the Tobacco Institute of the Chinese Academy of Agricultural Sciences also produce annual cumulations for user needs.

3. Supplying timely and accurate information to users in rural areas

For solving the contradiction between large information needs and a low actual use rate, it is a key solution to change passive services into initiative services, and to change store-type public services to utilization-oriented public services particularly for meeting the needs of agricultural production.

Following the agricultural reform in rural areas in recent years, a lot of agricultural societies and associations of agricultural technicians and farmers have been established. Now such units total 78,000 in China. They have a great need for agricultural information on new technologies, renewal of productive conditions, better disposition of each productive factor, development of new projects and practices of new techniques, as well as investigating the results of resources and experiences for integrated utilization of techniques in various fields in agriculture. Facing such great information needs, library and information centers at different levels coordinate and cooperate with each other for a better supply of information services. The main services are the following:

- Establishing reading rooms in villages for farmers;
- According to actual needs of farmers, to send practical and technical information and materials to them;
- Setting up agricultural scitech archives to keep in contact with users;
- Regularly organizing book shows for farmers in rural areas;
- Organizing activities to promote the reading of books and newspapers;
- Holding agricultural news press conferences to transmit agricultural information and promote the exchange of information and techniques as well as their actual use for production;
- Organizing lectures and training courses.

Generally, in recent years, many library and information services have been offered by library and information centers in rural areas in China. However, it needs further coordinating and planning based on the country as a whole. The network of library and information centers is very much in need of efficient user services at different levels. Large libraries have huge collection resources and better information transmitting conditions; libraries below provincial levels are aware of the actual needs of farmers and their organizations. All these libraries at different levels which cooperate with each

other to form a multi-level system of information supply will be a good start to making the library collections used efficiently and become a useful tool in the improvement of agricultural production.

In general, we are in the era of "information inflation." Scitech documents may be doubled during a ten year span. However, a document's useful life is decreasing. Library and information centers should be timely in identifying, processing and transmitting scientific and technical information in agriculture for the quick use of various users. Doing better in our user services relates directly to national agricultural production and has far reaching significance for the development of the country's economy. All librarians and information specialists should be clearly aware of the current situation of user needs in order to further improve the user services in agricultural information sciences.

Results and Benefits from an IDRC-supported Project: Tea Information Services (China)

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Abstract

An information service project, Tea Information Services is being carried out by the Tea Research Institute (TRI), Chinese Academy of Agricultural Sciences (CAAS) with the aid of a grant from the International Development Research Centre (IDRC). In addition to supporting the Sparks Program of the Chinese Government by disseminating technology and information to tea farmers and tea entrepreneurs in China, the project also seeks to share China's experience and achievements in tea research, production and utilization with other developing countries. The results and benefits are obtained as follows: 1) Economic and social benefits are remarkable at the tea demonstration sites, 2) Information services are effectively offered. Apart from day-to-day advisory services to tea farmers by eight scientists at four demonstration sites, three tea farmers' training courses with 160 participants have been held, and 333,500 publications including periodicals, Tea Farmer's Pocketbooks, Tea Technology Leaflets, etc., have been published and distributed. 3) The capabilities of the information services of TRI itself are obviously improved.

Introduction

Tea originated in China and has been cultivated, processed and used as a beverage by the Chinese for about 3,000 years. Many countries' tea plants were received directly or indirectly from China. In China, tea is not only the favorite beverage but also a traditional export commodity, taking an important position in the national economy. In 1989, tea export was up to 204,500 tons with foreign exchange of USD 480 million.

Since the reform of the economic system in China in 1979, individual tea producers contribute the main tea yields of China. It is estimated that there are one million tea farmers and they contribute 70% of the total tea yield. However, the productivity level of these smallholders is very low due to a lack of new technology. For example, the unit products of many smallholders' tea fields is less than 50 kg/mu (i.e., 750 kg/ha). If the technology developed in research institutions is transmitted to the smallholders and transformed into productivity, the unit area yield is easily improved to 150 kg/mu (i.e., 2250 kg/ha). Undoubtedly, it can enhance the capacity of tea farmers to earn their own living. Because of some barriers, including an information barrier, the above-mentioned distribution and transformation is not effective in China. In order to upgrade the Tea Research Institute's (TRI) capacity to organize its information activities and to package materials in formats which will assist in the direct transfer of technology

from the tea scientist to the tea farmer, an information service project "Tea Information Services," is being carried out by TRI. The project is supported by the International Development Research Centre (IDRC) from June 1988 to May 1991. In addition to supporting the Sparks Program of the Chinese Government by disseminating technology and information to tea farmers and tea entrepreneurs in China, the project also seeks to share China's experience and achievements in tea research, production, and utilization with other developing countries.

Activities of the Project

- To publish journals, technological leaflets, teaching materials for the Tea Farmer Training Course, etc. The journals include an academic journal, *Journal of Tea Science*, a popular technical journal, *China Tea* and *Tea Abstracts*. The teaching materials include six *Tea Farmers' Pocketbooks*, three video tapes and six sets of slide shows. *Tea Microthesaurus*, in 2 versions (Chinese/English and English/Chinese), will also be published.
- To build up a machine-readable bibliographic database containing about 30,000 items.
- To organize tea farmer training courses on tea processing, pest control of tea plants, installation and repair of tea machines, improvement of tea quality, regeneration of low-yield soil, and utilization of tea by-products.
- To provide extension activities at tea demonstration sites, TRI has established four technological demonstration sites in rural areas supporting the principle of the Sparks Program. Eight TRI scientists have been posted to provide extension activities at these sites, each for six months per year. All the information products and services of the project are utilized at these sites, to effect the transfer of technology to the tea farmers. The outputs are disseminated by TRI's demonstration site scientists and by the agricultural extension personnel of the county level governments.
- To provide day-to-day tea information services both inside and outside China. These services include advisory services to tea farmers, reference services, document delivery, translation and literature searching.

Results and Benefits from the Project

1. Notable Economic and Social Benefits at Tea Demonstration Sites

a. Demonstration site for multi-processing of tea in Fuyang County

The demonstration site (including four demonstration bases) was set up in 1985 in Fuyang County and selected as a project of the Sparks Program of Zhejiang Province in 1986. With the aim of producing different kinds of tea according to the availability of fresh leaves, the main task for the site was to overcome the weak points of rural tea factories in which only a single kind of tea could be processed. Through three years of technical advice and training, various kinds of tea now can be produced in the factories

such as Broken Black Tea, Congo Black Tea, Jasmine Tea, Meicha (Eyebrow Tea), Longjing Tea and Qiqiang Tea (Spear Tea). In the years 1986 to 1988, 1,560 tons of tea were produced from the four demonstration sites with RMB 13,160,000 yuan of total output value, 2,769,000 yuan of profit and tax, and USD 104,400 of foreign exchange. It was also noted that 120 technicians from the factories were trained in the techniques of tea processing. For further extension of the experience achieved, the sites were visited by many people from the rural tea factories in other parts of China. The project was awarded the 2nd Class Prize and the 1st Class Prize of the Sparks Program by the governments of Zhejiang Province and Hangzhou City respectively.

b. Demonstration site of black tea processing in Zhenhai County.

The site was set up in 1985 based on a village tea factory, to aim at improving primary and refinery processing of black tea in rural tea factories and scientists have been posted to provide advisory services all year around. Before the site was set up, the productivity of the factory was only 110 tons of primary made tea, with RMB 330,000 yuan of output value per year. The net profit was less than 3,000 yuan. Since the establishment of the site, the productivity has been significantly improved. In 1988, the factory produced 280 tons of made tea with RMB 2,000,000 yuan of output value. The tax turned over to the government amounted to 525,000 yuan and the net profit was 150,000 yuan. The investment on fixed assets increased from 120,000 yuan in 1984 to 600,000 yuan in 1988. Apart from increasing their personal income, the farmers in the village were favored with the following improvements brought about by the accumulated surplus of the factory: 1) All the households (916) were installed with running water which improved the sanitary conditions of the drinking water, 2) A concrete road through the village, 5,000 km in length and 15 m in width was built up, 3) A closed-circuit TV system was installed for 95% of the village households.

There are four such tea factories with about 100 trained technicians in the county now, which is a solid foundation for further development of the tea industry in the county.

c. Demonstration site for propagation of good tea varieties in Fuyang County.

It was set up jointly by five individual tea smallholders in 1988. At the site, TRI scientists offered not only technical advice but also provided cuttings of good tea varieties which were bred at TRI. In 1988, about 600,000 tea plants of the best varieties, such as Longjing 43, Biyun and Longjing-changye were propagated and distributed to tea areas in Hunan, Anhui, Jiangsu, Jiangxi and Zhejiang Provinces. The gross income of the smallholders was up to RMB 36,000 yuan. It is estimated that 1,200,000 tea plantlets were produced from the site in 1989. This will play an important role in the popularization of good tea varieties developed at research institutions.

d. Demonstration site for producing a special compound fertilizer for tea in Shangyu County.

Based on a fertilizer formula developed through years of experiment by TRI, the Shangyu Fertilizer Factory began to produce a special compound fertilizer for tea in 1987. The fertilizer products were distributed by TRI to tea areas according to the different soil conditions. In 1988, the factory produced 25,000 tons of compound fertilizer, which were applied to about 24,000 hectares of tea fields in Zhejiang, Jiangsu and Fujian provinces, and resulted in an increase of 250 tons of made tea in total.

2. Effective Information Services

Publication is one of the main methods of information services in China. Since implementing the project, 289,500 copies of four periodicals, i.e., *Journal of Tea Science*, *China Tea*, *Tea Abstracts* and *Tea News* have been published and a vast amount of information has been therefore distributed to clients at different levels throughout the country.

Twelve issues of *Tea Technology Leaflet*, designed to introduce practical techniques and successful experiences to tea farmers, have been published so far. Much positive feedback from tea farmers has been received. For example, a technical article, titled "Efficiencies and Application Methods of Special Compound Fertilizer for Tea" was published in the issue of February 15, 1989. We received many letters from tea farmers, in which we were told that it was very helpful for them because they learned from it why and how to use the compound fertilizer. To meet the demands of tea farmers from various provinces of China, each issue was increased to 1,500 copies from the 1,000 copies of the first six issues, which was planned in the project proposal. Totally 24,000 copies of the *Leaflets* have been published. Furthermore, three *Tea Farmers' Pocket-books* covering black and green tea processing, pests and disease control and regeneration of low-yield tea fields have been published and distributed totalling 15,000 copies. These pocketbooks are written in simple language and are easy to understand. So they are used for not only the materials in the tea farmer training courses but also as useful tools in actual production. In order to improve the tea farmer training courses, two sets of video tapes and three sets of slide shows have also been produced.

Face to face advisory services are very important to disseminating information and technology to tea farmers. Therefore, eight TRI scientists have been posted to tea demonstration sites offering day-to-day advisory services. All the information products have been disseminated to the sites by the scientists. In addition, three tea farmer training courses have been held with 160 participants. These participants, mainly technicians of technical extension units at the county level from ten tea-producing provinces, play an important role in tea production.

In addition to the face-to-face services at fixed sites, we also keep in communication with more than 1,000 agricultural extension technicians and tea farmers throughout China by mailing our information products to them regularly. Among more than 400 feedback letters, 70% said that they were remarkably benefitted from our services. Furthermore, we have replied to more than 2,000 letters from tea farmers to answer various technical questions on tea production.

On overseas academic exchanges, TRI has established relationships on document delivery, and exchange of publications with forty organizations and institutions in Kenya, Indonesia, Malaysia, Sri Lanka, India, Japan, USSR, England, USA, France, Federal Republic of Germany, etc. The exchanged documents are mainly *Journal of Tea Science*, *China Tea* and *Tea Abstracts*. The project leader and manager who visited Indonesia and Malaysia in March, 1989 have established relations with scientists and information personnel of those two countries and the academic exchanges will be further developed in the future.

3. Improvement on capabilities of information services

At present, there is a shortage of funds for development of an information industry in China. However, helped by IDRC, the Information Department of TRI purchased some library equipment and furniture, two IBM PS/2 microcomputers, one laser printer and one photocopier, so that the working conditions are obviously improved. Two librarians were sent to be trained in generating machine-readable databases with Micro CDS/ISIS software in the Sciencetech Documentation and Information Centre, Chinese Academy of Agricultural Sciences in Beijing. Two information specialists were also assigned to attend a training course on New Information Technology and Computerized Library Services at the Asian Institute of Technology, Bangkok, Thailand. All these are beneficial to improve the capabilities of information services offered by the Department. For example, the microcomputers are now used in daily work, especially in the work of establishing a bibliographic database on tea production and marketing.

On the other side, information work and services of the Information Department have also been promoted to a higher level. For instance, lots of work and services, mainly services to tea farmers and international documents exchange, have been developed since carrying out the project. In addition, the Information Department has won the information achievement prize issued by the Commission of Science and Technology of Zhejiang Province and the excellent journal prize issued by the Agricultural Society of China.

Conclusions

Offering information services is an important way to transform technology into productivity. Concerning the actual production and offering of information services, there are some successful case studies for comprehensive information institutes, but not for a small information department in a special research institute, such as the Information Department of TRI. One important conclusion has been realized by carrying out the project. In addition to offering information services by itself to the target audience, it is more important for the department to participate in a team of multi-disciplinary scientists, which is organized by the institute leader for doing extension work. In the team, the information department takes the role of information support by providing suitable information products, making the scientists' extension work more effective.

Another conclusion is that some representative clients should be selected and communicated with frequently. For instance TRI pays more attention to the extension work at demonstration sites and the its communications with more than 400 tea smallholders. As a result, the achievements from the sites and the smallholders are more attractive to the general clients. On the other hand, some technical problems can be discovered from the sites and the smallholders, which makes our extension work and information services more directed toward actual production.

Practice and Enlightenment in Collection Development

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Abstract

This article proposes that scientific research must contact, accept, process and store a large amount of information. It describes how scientific collection development directly affects the development and success of scientific research. It describes the general situation of collection development in the institute, and puts forward nine optimum countermeasure suggestions for scientific collection development.

Scientific research is a process in which information regarding the objective is discovered, probed, and collected. This process brings to light the essence of the developing law of matter. It requires contacting, accepting, handling and storing a large amount of information. From item selection and planning of the scientific research to the analysis and testing of a theory, to the appraisal of the results, they are all dependent on scientific documentation. We can say that good or not, the work of collecting scientific documents directly affects the development and success of scientific research.

Scientific document collecting is the vanguard of all document services and the one which decides the ultimate effect of the information services. Nowadays, science and technology are developing and changing with each passing day. We are far from meeting the requirements of scientific research when we still observe traditional methods of collecting scientific documents. The situation requires all document activities to probe new methods and to seek out breakthroughs in collecting documents.

I. The Practice of Collection Development in the Subtropical Forestry Research Institute

"Collecting document information" is work in which highly useful information can be obtained for a department out of a large amount of documents circulating in the world. All document resources and the information requirements of users should be determined. The rules and methods of document collection should also be probed. It is not enough simply to mark up book orders or to go to bookstores to buy some books. This is a very complex and painstaking task dealing with ideological and scientific contents. Facing the multitude of scientific documents in existence, the difficulty of identifying documents in related fields in order to be comprehensive, and the high rate of time-sensitive obsolescence of scientific documents, it is often very hard to find some highly pertinent, valuable scientific documents.

The Subtropical Forestry Research Institute mainly addresses general, comprehensive, key and basic problems of science and technology in forestry. To change the situation of sharply reduced forest resources and to promote the cause of forest science prosperity in our country, we have developed our scientific document collection as follows:

1. Forestry science is a comprehensive applied biological science. It relates to more than twenty disciplines such as heredity, breeding, cultivation, meteorology, geography, math/statistics, agricultural soil chemistry, physiological biochemistry, plant diseases and insect pests, and computer science. It is necessary for us to bear in mind the scientific research being performed in the institute; to stress our specialties and take notice of our comprehensive areas, and to try our best to deal with the ratio between specialized and general books and periodicals of developed countries and areas. For a long time, we have insisted on using statistics to analyze and calculate the makeup of the collections such as subscribed books, books by categories, and magazines.

2. We also use it in fund accounting. We have gained fine results. Through the comparison of statistics we can examine whether the collected documents fit the requirements of the research in progress. This helps us collect pertinent documents which have scientific value. It is useful for us to try to find out the rules of document collecting, regulations, range and rate. Let me take some examples: First, book ordering funds for key books, and general books and periodicals are kept at the rate of seven to three. Second, is rates by subject category. Heredity and breeding books: 25%. Basic theories (natural science) books: 22%. Applied science books: 20%. Insect pest books: 6%. Soil chemistry books: 6%. Reference books and foreign language books: 15%. Scientific and technological management books and advanced foreign language and reference books: 4%. Social science and art books (biography): 1%. Third is based on the language of text. Chinese books and periodicals: 75%. English: 15%. Japanese language materials: 6%. Russian: 4%. These rates, of course, may change. They will be readjusted to fit the charge of a particular project of scientific research. According to the rule of Bradford's Law: A certain special subset of documents only can be published in a special publication at the rate of 50%, and the other 50% may be published in other periodicals. We tracked and analyzed the research projects in our institute and the requirements of the researchers. First, to try to find out what research projects are going on in the institute and who is involved, we went directly to the project groups to ask what their needs were during the entire research period. At the same time, we printed out relevant investigative forms to learn the documents requirements of the researchers. For example, since they got timely access to new grafting methods from a year book of "American Camellia," the scientific researchers soon broke through the technical barriers of rape mud and seedling graft. They also used the newly tested methods in other tree propagation for improving seeds. The projects received a third class award from The Ministry of Forestry. Second, according to the characteristics of large quantity information needs and transfer, we choose middle-aged scientists to follow the main tracks of information. We insist on tracking them and try to understand the overall situation of relevant document requirements in order to raise the quality of document collecting and to enhance the ability of distinguishing documents.

3. It will cause a lack of activeness when the whole scientific and technological information system loses feedback information. To continuously try to get an effective use of information is the aim of information services. In the same way, feedback information is an effective way to objectively appraise the quality of work of acquisition librarians. To track and collect feedback information from document use is a step in collection development. Over the years, we try to follow and collect information on document use by scientists. First we carry out investigations using questionnaires once or twice a year. We have received about a hundred useful feedback papers. Five of them were exhibited on Zhejiang Foreign Language Book and Magazine Utilization Effect Shows and attracted the attention of the parties concerned. Second, we calculated the amount of the articles and quotations written by the institute scientists in two magazines, namely *Forestry Science*, and *Forestry Science and Technology Communication*, from 1983-1986.

Through this, we get to know the status of the utilization of library collection. The investigation shows that the scientists in our institute have published 106 articles and quoted 410 documents as reference. Eighty percent of the quoted documents are in our library's collection. So we can know on a timely basis the document requirement tendency and learn what documents are badly needed so that we may alter our document collecting rules. The investigations help us to continuously adjust the document collecting rates of different languages and disciplines. In this way, we have established a good procedure to get feedback information from the scientists. We try to make them cooperate actively, to develop new collecting methods, to raise the quality of acquisitions, and raise the efficiency of using the library collections.

The above practices show that it is only by taking the users as the main focus of service, by continuously following the efficiency of use, and by trying to find out and sum up the rules of collection development that we can meet the needs of scientific research.

II. Some suggestions on optimum collection development

Nowadays, there are many limits in manpower, financial, and material resources in collection development. So we must tightly center on the orientation of scientific research in the institute and the service objective, and develop different ways to collect documents and pay attention to the existence of other information units so that we may get better results in collection development. In consideration of these, we suggest as follows:

First, according to the characteristics of tasks, subjects and research of those using documents in our institute, the collection ranges, main points, quantity, scale, and languages shall be adjusted to fit the need of the institute. The titles of key scientific and technical documents which are of high use should be determined.

Second, the key of collection development is to timely meet the readers' requirements. The acquisition librarians must know the readers' requirements, to effectively collect documents according to the current and long-term requirements. At the same time,

they shall take some effective measures to encourage scientists to cooperate in collecting documents for their own subjects.

Third, the acquisition librarians should have an economical mind especially in a day of shortage of funds. They should take an active interest in how scientific research is done by the scientists, especially the leading people. They should know what documents are suitable for them and which are not. All this helps collection development not only with improving its focus but also with an improvement in information transfer.

Fourth, the acquisition librarians should continuously track the information needs of scientists, so as to become a valued resource of the scientists.

Fifth, the acquisition librarians should often go to visit scientists, especially leaders in subject areas because the leaders have more chances to collaborate with important researchers and to write special articles. The acquisition librarians can share timely information about publications at home and abroad.

Sixth, since collection development requires a scientific approach, there must be working rules for it. The scientific management of library information work requires the skillful use of mathematics. Through this, the collection development service will reach its optimum target. In the process of document collection, the scientific methods of document statistics should mostly be used with analysis and comparison to find out the optimum system of collection.

Seventh, the feedback of use efficiency is a useful way to check document collection work. A system of collection tracking and regular use efficiency feedback should be set up among bookstores, acquisition librarians, and readers. It helps us continuously send useful documents to scientists and can reduce mistakes in collection development.

Eighth, the acquisition librarians must carry out the "spirit of the nail" to be adept at mastering clues to ascertain the source of needed documents. The phrase "spirit of the nail" comes from a story about a modern Chinese folk hero, Lei Feng, who took advantage of every available moment to study and work intensively, like a nail being driven into a piece of wood. They should pay attention to their goals, the planned system and projected needs and try their best to get valuable document information.

Finally, acquisition librarians should try to join in the selection and determination of scientific research subjects and lay down plans of scientific research. Those who have the capabilities may assist the scientists to get information in their research periods. In a word, the investigation before collecting, the organization after collecting, and the provision of various conveniences for the efficacious use of documents are very important in collection development. Since book prices are going higher the librarians should make a catalog for information sharing. Only in this way, can the collection development service can be deepened and developed.



Opening Address

WANG Xianfu

*Chairman, the Organizing Committee of the Symposium
and
Director, SDIC/CAAS*

The International Symposium on New Horizons in Agricultural Information Management that we have been looking forward to for so long now begins. There are more than seventy participants from more than ten countries including Fiji, the Federal Republic of Germany, Indonesia, Japan, Malaysia, the Philippines, Sri Lanka, Thailand, the United States of America, the People's Republic of China, etc. Participants are also here representing several international organizations, including AGRIS, CIP, and ICRISAT. The Chinese participants are mainly from the National AGRIS Center of China and its seven regional subcenters, and information institutes of provincial academies of agricultural sciences, agricultural universities and colleges. I would like to thank Mr. Clive David Wing, the regional project officer of IDRC for making a special trip to attend this symposium. On behalf of the Organizing Committee of the symposium, I would like to extend a warm welcome and sincere thank-you to all participants and friends who have come to China from afar, and special thanks to Mr. Wang Tingjiong, Director of the Department of Scientific and Technological Information, the State Science and Technology Commission, and Vice-President of the China Association of Information, and to Prof. Liang Keyong, Vice-President of the Chinese Academy of Agricultural Sciences for their guidance to and presence at this symposium. I would also like to express heartfelt gratitude to the correspondents and photographers from CCTV, Radio Beijing, *Guangming Daily*, *Science and Technology Daily*, and *China Youth Daily* for covering the symposium.

Welcoming Address

LIANG Keyong

Vice-President

Chinese Academy of Agricultural Sciences

I am very honored to attend this International Symposium on New Horizons in Agricultural Information Management. First of all, please allow me, on behalf of the Chinese Academy of Agricultural Sciences, to extend the warmest welcome to you all: representatives of various countries and international organizations, and Chinese colleagues.

This symposium is a result of the long-term successful cooperation in agricultural information between China and the International Development Research Centre (IDRC). China's project to improve agricultural information services has been supported by IDRC since 1986 and significant results are improving the media for transmitting agricultural information, forming an agricultural information network, establishing databases and training information personnel. These consequently make China's agricultural scientech information rise to a higher level. On this pleasant occasion, I would like to express my heartfelt gratitude to IDRC for its support of the project and of this symposium, and my sincere appreciation to Mr. Clive Wing, Regional Program Officer, Information Sciences Division, IDRC, for his presence at this symposium.

Agriculture is an issue of common concern to all countries in the world. How to settle the problems commonly facing us in developing agriculture by using modern scientech achievements is undoubtedly an important task for those of us who are working on agricultural information, especially with the current situation in which the population continues to increase while agricultural resources decrease at the same time. As everyone knows, China is a large agricultural country with a large population. It is a fundamental policy for us to coordinate agricultural development steadily over a long period of time. At present, China is practicing a policy of rectification and improving administration, going farther in reforms and opening up to the outside world. We shall continuously strengthen exchanges and cooperation in agricultural information with foreign countries. Being a developing country, China started her agricultural information services rather late, and we need to incorporate experiences from other countries, particularly in information technology, information management, and the development and use of information resources, etc.

During this symposium, discussions will be focused on the role of the construction of national agricultural information systems in promoting the development and sharing of information resources, the strategic status of the establishment of databases, and efficient methods for transforming scientech information into productivity.

There is no doubt that this is a good opportunity for all of us to exchange our experiences. I believe that, with mutual efforts from all our colleagues both at home and abroad, this symposium will achieve excellent results in exchanging information technologies, setting up cooperative agreements, and strengthening friendships.

Welcoming Address

Clive David WING

*Regional Program Officer
Regional Office for South East and East Asia, IDRC*

It is a pleasure to be back in China and to be asked to welcome you and say a few words at the inauguration of this Symposium on New Horizons in Agricultural Information Management.

I was remarking to Prof. Wang Xianfu, Director of SDIC that the speakers who have come here from the region represent Asia's leaders and innovators in agricultural information management and that we are extremely lucky that they could all find time to visit Beijing. On the other hand, looking through the agenda I see that the speakers from our host country also have a wealth of knowledge and experience to share with us. Obviously, ladies and gentlemen, this meeting of minds is good for us all because in the course of the next few days we are going to learn of new services, ideas, and techniques which will enrich our own knowledge and thinking. We are going to have the chance to talk with our colleagues from China and forge links which will benefit not only ourselves but those who use the systems and services which we represent. This is important because one of the great challenges of the nineties is to effectively manage agricultural information in all its different forms so that food production keeps in step with advancing population growth, declining soil fertility and contraction of arable land, and increasingly, changes in the world's climate. I am sure we are up to the challenge!

I would be failing in my duty if I didn't thank our hosts for their wonderful hospitality and the excellent organization of this symposium. In particular Prof. Wang Xianfu and his hardworking colleagues and organizing committee deserve our support and appreciation for their efforts. Indeed, as with many of you, I am meeting Prof. Wang for the first time even though he and IDRC have worked together for several years now. The fruits of our collaboration have been very real and we will have a chance to learn about them during the course of the symposium.

I bring greetings too from IDRC, from my colleagues in Singapore and from our head office in Ottawa, Canada. Indeed, my Director Mr. Paul McConnell asked me a few days ago to convey his best wishes for a successful deliberation. Finally, ladies and gentlemen, I am sure that you will use this opportunity to get to know each other and discover ways that you can collaborate in the future. From my side, I look forward to listening to your papers and learning about your work and plans for the future.

Welcoming Address

WANG Tingjiong

Director

*Dept. of Scientific and Technological Information
The State Science and Technology Commission*

I am very glad to be here with you at such an impressive international symposium. On behalf of the Department of Scientific and Technological Information, the State Science and Technology Commission, and the Institute of Scientific and Technological Information of China, I would like to extend my warm congratulations to the participants in the symposium, and my gratitude to IDRC for its support of the symposium.

China's agriculture has been developing at a relatively rapid speed since the policies of reform and openness to the outside world have been in place. China successfully supports 22% of the world's population with only 7% of its arable land. Our agricultural information institutions have been carrying out effective information services for the development of China's agriculture. Meanwhile, the institutions themselves have been developing rapidly, and have been receiving much attention from our government and support and cooperation from international organizations.

The project supported by IDRC to improve Chinese agricultural information services has been successfully implemented and significantly beneficial results have been obtained. The implementation of this project has resulted not only in the establishment of China's National AGRIS Center and seven regional AGRIS subcenters but also in the construction of agricultural information databases and information dissemination networks. Furthermore, it has enabled Chinese agricultural information institutions to become members of international agricultural information networks, and allowed Chinese agricultural information resources to join in the circulation of agricultural information around the world. All these will surely have a profound influence on and practical significance to the development of Chinese agricultural information services and its international exchange. We appreciate very much the foresighted project to improve Chinese agricultural information services, and are very grateful for the support and cooperation of IDRC.

Agricultural information services is one part of the scientech information scene. It has a heavy burden and has a long way to go in increasing agricultural production by improving access to science and technology. There should be a new horizon for the development of information resources, information management and services, and their technology in order to transform science and technology into productive forces as soon as possible and to make contributions to the development of agriculture throughout the world. It is also the main topic of this symposium. I am convinced that all of you, the experts present here, will present more new theories, ideas, techniques and methods, and make still greater contributions to the development of international

cooperation and exchange of agricultural information, and to the development of agriculture in various countries of the world.

Discussion

Group I:

What are the New Horizons in Agricultural Information Management?

1. Based on the formal presentations and discussions during the International Symposium, the participants agreed that there was considerable scope for the exchange of software, databases, experiences, expertise, and documents among the Chinese National Agricultural Research Systems (NARSs) and other NARSs, Regional Information Programs, and International Agricultural Research Centers (IARCS). It was also recognized by the participants that mutual sharing of the above mentioned resources and experiences among the different Chinese Agricultural Research Centers would facilitate better information management in China.

Participants recommended that SDIC-CAAS should play a lead role in furthering the useful contacts established during this symposium in acquiring needed inputs in meeting the goals for better information management and utilization of new technologies for information management in China.

2. On the other hand, participants from outside China, i.e., from NARSs Regional Programs and IARCs, recognized the need to engage in ongoing exchanges with relevant Chinese NARSs through conventional methods as well as through modern means such as electronic mail.

Participants recommended that SDIC-CAAS should explore the possibility of joining international electronic mail systems in which other national, regional, and international programs already participate.

3. Participants recognized that the first priority of SDIC-CAAS is to provide easier and wider access to information by agricultural researchers in China. In the long run however, greater emphasis should be given to the needs of extension personnel and farm producers once the SDIC's capabilities in this area improve.

Group II:

The Strategic Significance, Methodology and Ways of Transferring Agricultural Sciencetech Information into Productivity.

1. The participants recommended that when strategies, methodologies, and transfer of agricultural methodology is planned, the questions of for whom, by whom, from whom, what, how, and why should be carefully considered.

2. The participants recommended that an international coupon scheme be developed in order to facilitate document delivery. The proposed AGRIS/CARIS coupon scheme may be a solution for this need.

3. It is recommended that channels and resources should be explored to improve training at all levels required for both users and information specialists.
4. The participants recognized the wealth of information resources available in China that are not widely used by other countries. It was recommended that China take an active part in international resource sharing. It is understood that this should be based on a sound national network of information exchange, giving attention to the development of information systems, infrastructure, and human resources at regional and provincial information centers within China.
5. The participants recognized the efforts underway to overcome the language barriers by supplying database translations into Chinese, and supplying English titles and abstracts for Chinese documents.
6. The participants appreciate the collaborative efforts that have been undertaken with China, and strongly recommend further positive actions along this line.
7. While recognizing the value and important developments in bibliographic information systems, the participants recommended that non-bibliographic information systems be given proper attention and resources to better serve the user community.
8. To insure that information services are oriented towards achieving improved productivity, the participants recommended that evaluation of services be conducted on a regular basis and experiences in this area be shared.
9. The participants recognized the significant contribution of IDRC in the development of the Chinese Agricultural Information Systems and services as well as that of other international systems.

Summary Report of the International Symposium on New Horizons in Agricultural Information Management

Beijing, China, 13-16, March 1990

INTRODUCTION

Convening of the Symposium

Attendance at this symposium was invited by Prof. Wang Xianfu, Director of the Sciencetech Documentation and Information Centre, Chinese Academy of Agricultural Sciences (SDIC-CAAS) and Chairman of the Organizing Committee of the Symposium, addressed to the related institutions and agricultural colleges or universities of the member nations of AGRIS and to international institutions in or cooperating with AGRIS.

General aims

The general aims of the symposium were to review the progress and implementation of the Project on Agricultural Information Services in China (which has been greatly assisted by the International Development Research Centre of Canada (IDRC)), to explore the functions of agro-information construction in developing countries in the promotion of resource development and sharing, the strategic position of database establishment, and the methods and techniques of transforming sciencetech information into productivity.

Participants

The Symposium was attended by 76 participants from ten countries and four international organizations. The names and their organizational affiliations of participants are listed in Appendix 2.

Opening of the Symposium and Introductory Statement

The Symposium was opened by Prof. Wang Xianfu, who welcomed the participants on behalf of the Organizing Committee of the Symposium. Prof. Wang also extended his warm welcome to Mr. Clive David Wing, Regional Project Officer, Regional Office for Southeast and East Asia, IDRC, who made a special trip to attend this Symposium. Prof. Liang Keyong, Vice President of the Chinese Academy of Agricultural Sciences gave the keynote address at the opening ceremony. Prof. Liang gave a high appraisal of the successful cooperation between SDIC-CAAS and IDRC. In his welcoming address, Mr. Clive David Wing expressed his thanks on behalf of IDRC and the overseas participants, for the wonderful hospitality and excellent organization of the symposium. Finally Mr. Wang Tingjiong, Director of the Department of Scientific and Technological Information, the State Science and Technology Commission delivered his welcoming address. He spoke highly of the foresighted project of Chinese agricultural information services and expressed his deep appreciation for the support and cooperation of IDRC.

Session Chairs and Group Chairs of Discussions

Dr. Ruben C. Umaly (Indonesia) was elected chair of Session I. Dr. Chunpei He (China), Dr. A. Mangstl (FRG), Dr. L. J. Haravu (ICRISAT), and Prof. Zeng Minzu (China) chairs of Sessions II - V.

Dr. Josephine C. Sison (The Philippines) and Dr. Carmen Siri (CIP) were elected chairs of the two discussion groups.

Coverage of the Symposium by the Chinese Public Media

The opening ceremony of the Symposium was aired in the News Program at 7:00 P.M. March 13, 1990 by CCTV-1, and re-aired at 10:00 P.M. on the same day by CCTV-2. The opening and convening of the symposium were aired by Radio Beijing on March 14, 1990.

The *China Youth Daily* also reported the opening of the Symposium on the front page with a large photograph of the opening ceremony on March 14, 1990. On the same day, *Guangming Daily* and *Science and Technology Daily*, two famous news agencies in the academic sector also reported the opening and convening of the Symposium with considerable coverage.

Appreciations

Participants recognized the significant contribution of IDRC in the development of the Chinese Agricultural Information Systems and Services as well as other international systems.

Participants appreciated the presentation given by Prof. Ching-chih Chen, Associate Dean of the Graduate School of Library and Information Sciences, Simmons College, U.S.A., which demonstrated the new technology of hypermedia at this Symposium.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

This international symposium bears the title of New Horizons in Agricultural Information Management. The word 'horizon' is a dynamic concept which could well have different meanings in different countries at different historical stages. Generally speaking, it is agreed that it has, by and large, the following concepts at present time in the third world:

1. The construction of national and regional networks

Participants of the Symposium realized that coordination and networking are the weakest facet of agricultural and other information systems in the developing world. Many information services in the developing world fail to meet the needs of users in terms of efficient document delivery and broad access to information.

Effective networking and sharing of resources require reliable and rapid intercommunication between facilities and the means to quickly access and search remote databases. The centralized vendor systems such as DIALOG and utilities such as OCLC

have enabled rapid access to databases and effective communication between libraries world-wide and have greatly facilitated interlibrary lending and other forms of cooperation. However, this kind of luxury is unaffordable in the third world. The trend is towards distributed processing and distributed networking. The initiatives must come from a centralized agency with a perspective that decisions and actions will gradually devolve to local systems as they become more computer-proficient and as the communications infrastructure of the country improves.

Participants agreed that it is essential to set up at least one center in each country or region. Such a center should perform a set of functions. It should be able to:

- develop and maintain a union catalog;
- enable the exploitation of external databases;
- promote the use of international standards as well as national standards in information handling;
- promote the development of local databases in specialized disciplines or sub-disciplines;
- provide consultative services;
- advise on hardware and software acquisition;
- provide training in computer-based methods;
- develop generic software or applications within the network;
- assist in conducting user needs studies and user-awareness programs;
- provide a forum for managers of local systems for discussions on specific issues which lead to better coordination and cooperation;
- bridge the exchange with other national, regional or international centers on the basis of mutual benefits.

Strengthening the national agricultural information systems would serve the establishment of regional information networks as partnerships among national agricultural research systems (NARSs), regional agricultural information programs, and International Agricultural Research Centers (IARCs) information programs.

While recognizing the value and important developments in bibliographic information systems, the participants recommended that non-bibliographic information systems be given proper attention and resources better serve the user community.

II. The Development of Small-Scale Computer Systems and Distributed Processing and Networking

The technology of library networking in the developed world began with large centralized bibliographic utilities (e.g., OCLC, RLIN) connected to libraries through leased lines. However, now local systems are acquiring the capability to link with each other for shared cataloging and interlibrary lending. The trend clearly is towards a decreasing

dependence on shared remote computer facilities and an increased cooperation on a small scale among libraries with a very high affinity of interests.

Small-scale computer systems are what the developing countries can afford and are good for distributed processing of agricultural information within a country's network.

Participants recognized that the software industry is today's driving force of the information technology revolution. Mini-Micro CDS/ISIS (version 2.3) developed by UNESCO has enabled many local subcenters equipped with microcomputers to provide agricultural information services.

In addition, the development of CD-ROM has the potential for a breakthrough in the transmission of scientific and technical information to developing countries. All three major databases in agriculture: AGRICOLA, CABI, and AGRIS are available on CD-ROM. It is clear that CD-ROM, particularly for agricultural information centers, is a medium that cannot be ignored by developing countries. Participants anticipated that CD-ROM will enhance the dissemination of agricultural information for small-scale computer systems in the developing world.

III. Training of Agricultural Information Staff in Developing Countries

Participants in the Symposium agreed that for better utilization and development of document sources, various training opportunities seem to be very much needed for both librarians and information staff, as well as for information users. The capacity for education and training of information personnel in different parts of the developing world is highly variable and in some countries it is non-existent. Further, there is a shortage of facilities to train information personnel in skills required to utilize newer tools and techniques in information handling. Dr. Haravu suggests that the situation requires the following responses:

1. development of training materials;
2. more opportunities for on-the-job and hands-on training in better-equipped information facilities of the developing world, e.g., at IARCs.
3. strengthening of national capacities and opportunities for training of trainers.
4. collaborative action by international agencies (e.g., IAALD, FID, UNESCO, CTA, etc.) to set up need-based regional training courses;
5. travelling workshops where one or two experienced information specialists spend a few weeks in selected national centers in training and demonstration.

It is agreed by participants that in order to increase user satisfaction, it is essential to regularly renew the knowledge of information staff to acquire the capability for better, more timely and faster service for users. User training is of equal importance because one has to let the user know what he/she has and where the information can be obtained.

And eventually, the user could have a better understanding of the value of agricultural information.

It is recommended that channels and sources be explored to improve training at all levels required for both user and information specialists.

IV. Methods and Ways of Transforming Agricultural Information into Productivity

any papers of this Symposium dealt with the issue of methods and ways of transforming agricultural information into productivity. In order to achieve this objective, a user study should be conducted. The participants believe that users could be broken down into five categories: (1) researchers and students; (2) administrators and policy makers; (3) extension workers; (4) farmers, rural women and youth; and (5) the general public. The participants recommended that the questions of for whom, by whom, from whom, what, how and why be carefully considered when strategies, methodologies and the transfer of agricultural information are planned. It is a complex issue with a very sophisticated matrix. The paper presented by Dr. Teresa H. Stuart has set a good example for this issue in her PCARRD program.

To be able to monitor that information services are being oriented towards achieving improving productivity, the participants recommended that evaluation of services be conducted on a regular basis and experiences in this area be shared.

Participants recognized that the main reasons for user dissatisfaction with the services of agricultural and other information systems in the developing world may be summarized as follows:

- (1) Absence of customer-orientation in services;
- (2) Poor collections of information resulting in poor document delivery services and inadequate access to primary information;
- (3) Lack of exhaustivity and timeliness in information provision;
- (4) Inadequate capability to access external sources of information;
- (5) Inefficient methods of information storage and retrieval;
- (6) Lack of skills for repackaging and consolidation.

V. National and International Information Resources Sharing

Participants recognized that it is very important and urgent to strengthen international cooperation in agricultural information resource sharing.

Participants agreed that national and international information resource sharing is one of the best ways to offer effective services to users since no library could have an

exhaustive and comprehensive collection which could meet the needs of all users. Possible approaches for this are:

- inter-library loan within a region or a country;
- international library loan on proper agreement;
- electronic mail among countries if possible;
- CD-ROM for information transmission among libraries;
- computerized information networks;
- member countries of the AGRIS community should play an even more important role in agricultural information resource sharing world-wide.

Participants recommended that an international coupon scheme be developed to enhance international information exchange to facilitate document delivery. For example, the proposed AGRIS and CARIS coupon scheme may be a good solution for that.

Participants agreed that there was considerable scope for the exchange of software, databases, experiences, expertise, and documents among the Chinese National Agricultural Research Systems (NARSs) and other NARSs, Regional Information Programs, and International Agricultural Research Centers (IARCs).

Participants from outside China, i.e., from NARSs Regional Programs and IARCs, recognized the need to engage in ongoing exchanges with relevant Chinese NARSs through conventional methods as well as through telecommunications such as electronic mail.

Participants recommended that SDIC-CAAS explore the possibility of joining international electronic mail systems in which other national, regional, and international programs already participate.

RECOMMENDATIONS FOR THE FUTURE WORK OF SDIC-CAAS

Participants recognized the efforts under way by China to overcome the language barrier by supplying database translations into Chinese and supplying English titles and abstracts for Chinese documents.

Participants appreciated the development and collaboration efforts and activities which have been undertaken with China and strongly recommended further positive actions along this line.

Participants recommended that SDIC-CAAS play a leading role in furthering the useful contacts established during this Symposium in acquiring needed inputs in meeting the goals for better information management and utilization of new technologies for information management in China.

Participants recognized the wealth of information resources available in China that are widely used by other countries. It is recommended that China take an active part in international resource sharing. It is understood that this should be based on a solid national network of information exchange, giving attention to the development of information systems, their infrastructure, and human resources at regional and provincial information centers within China.

It was also recognized by the participants that mutual sharing of the above mentioned resources and experiences among the different Chinese agricultural research centers would facilitate better information management in China.

Participants recognized that the first priority of SDIC-CAAS is to provide easier and wider access to information by agricultural researchers in China. In the long-run, however, greater emphasis should be given to the needs of extension personnel and farm producers once SDIC-CAAS's capabilities in this area improve.

CLOSING OF THE SYMPOSIUM

The closing ceremony of the Symposium was presided over by Prof. Wang Xianfu. At the closing ceremony, Dr. Chunpei He, Vice Chairman of the Organizing Committee of the Symposium and Director of the Division of Information Systems, SDIC-CAAS delivered the summary report of the Symposium on behalf of the Organizing Committee.

Dr. L. J. Haravu, (ICRISAT) made a speech on behalf of the participants outside China. He gave a high appraisal of the organization of the Symposium and extended heartfelt thanks to the hosts of the Symposium for their hospitality and diligent work. He said: "Although the Chinese information scientists who participated in this Symposium claimed that they entered the field of computerized information systems only recently, we found that the work they have done at SDIC has reached a very high level of achievement. In fact, SDIC should really be congratulated for the excellent work that they have done in a very short period of time...."

Mr. Clive D. Wing delivered his closing address on behalf of IDRC and all the participants outside China. He spoke highly of the work done by SDIC-CAAS in China by saying: "... the extent and quality of research and development on agricultural information management undertaken in China has come as a revelation to many of us." He expressed his hope that "in the near future, we will be able to return the kindness and hospitality shown us by our Chinese hosts."

Under a cordial and friendly atmosphere, Prof. Wang Xianfu triumphantly declared the closing of the Symposium at 2:20 P.M. March 16, 1990.

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